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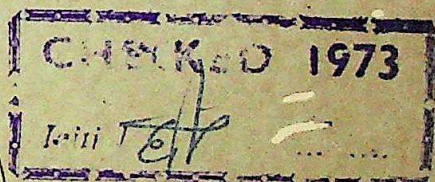


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BEAUMONTIA GRANDIFLORA (Roxb.) Wall.  
×  $\frac{1}{2}$

# JOURNAL OF THE Bombay Natural History Society.

1945.

VOL. 45.

No. 4.

SOME BEAUTIFUL INDIAN CLIMBERS AND SHRUBS.

BY

N. L. BOR, C.I.E., M.A., D.SC., F.L.S., I.F.S.,

*Forest Botanist,*

AND

M. B. RAIZADA, M.SC.,

*Assistant Forest Botanist,*

*Forest Research Institute, Dehra Dun.*

PART XXI.

[Continued from Vol. 45, No. 3 (1945), p. 279].

(With 1 coloured, 4 black and white plates and 6 text-figures).

**Beaumontia** Wall.

(This generic name commemorates the name of Mrs. Beaumont of Bretton Hall, Yorkshire, England).

A genus of tall, climbing shrubs. Leaves rather large, opposite, coriaceous. Inflorescence of terminal cymes; flowers large, white, fragrant; bracts often foliaceous. Calyx of five large, foliaceous sepals, glandular or not within. Corolla white, shortly tubular below, widely campanulate above, 5-lobed, lobes twisted. Stamens 5, inserted at the base of the campanulate portion of the corolla; anthers sagittate at the base, connivent around the stigma. Disk present. Ovary of two carpels; style filiform. Fruit of two follicles; seeds compressed ending in a tuft of hair.

**Beaumontia grandiflora** (Roxb.) Wall.

(Grandiflora means large-flowered in Latin).

**Description.**—This species is a huge evergreen climber which ascends to the tops of the tallest trees in its home, Assam, and covers the crown of its support with its beautiful foliage and flowers. The stem is woody with rusty pubescent shoots, and in old plants reaches a considerable thickness. The leaves are opposite, exstipulate, membranous to coriaceous in texture, ovate to ovate-oblong in shape, smooth and glabrous, rarely sparsely hairy beneath; nerves 7-16 pairs, arching and forming loops within the margin; reticulation prominent beneath; petiole  $\frac{1}{2}$ -1 in. long, sometimes especially in young leaves, rusty pubescent. Inflorescence a terminal cyme, few- to many-flowered. Bracts large and leafy. Calyx of five oblanceolate, obovate or lanceolate, acuminate segments, often glandular within,  $1\frac{1}{2}$  in. long, dark red, or reddish brown in colour.

Corolla 3-5 in. long, campanulate from a very short tubular base, with five large, rounded, acute lobes about 1 in. long, of a beautiful, pure white or cream colour, greenish towards the base without, glabrous or hairy. Stamens five, inserted on the corolla at the top of the tube, alternate with the lobes, anthers sagittate  $\frac{1}{2}$ - $\frac{2}{3}$  in. long, connivent to the stigma by their inner surfaces forming a five-sided cone, the stamens and style lying along the inner surface of the corolla. Ovary superior, seated on a five-lobed disk, 2-celled, with many ovules in each cell. Style filiform, expanding above into a fusiform stigma to which the anthers adhere. Fruit long, thick, woody, eventually dividing into two horizontally spreading follicles. Follicles turgid, fleshy, green, with a thick, hard, spongy, yellowish endocarp. Seeds many, compressed, ovoid or oblong, contracted at the top,  $\frac{3}{4}$  in. long, crowded, with a coma of hairs  $1\frac{1}{2}$  in. long.

**Flowers.**—March-April. **Fruits.**—Cold season.

**Distribution.**—Native of the Eastern lower Himalayas now frequently cultivated in gardens throughout India.

**Gardening.**—A huge and truly magnificent climbing shrub with large, white fragrant, trumpet-shaped flowers. It is of very rapid growth and ascends to the height of a lofty tree in no time. Propagated by seed, cuttings or layers.

**Economic uses.**—The young branches are sometimes used for making coarse ropes.

**Chonemorpha** G. Don.

A genus of high-climbing shrubs. Leaves opposite, broad, with distant nerves. Inflorescence paniculate, terminal or axillary. Calyx-tube cylindrical with an annular glandular area at the base inside. Corolla-tube cylindrical, slightly narrower at the base, ending above in five large twisted petals, horizontally spreading. Stamens five, epipetalous, connivent into a cone and adhering to the

stigma, sagittate at the base. Carpels two, distinct; style filiform; stigma thick. Fruit of 2 follicles.

**Chonemorpha macrophylla** G. Don.

(*Macrophylla* means large-leaved).

*Description*.—A scandent shrub capable of overtopping the largest trees; stems more or less pubescent, emitting quantities of a white latex if wounded. Leaves opposite, up to 10 in. long and as much broad, ovate, obovate or even orbicular in shape, rounded or cordate or even cuneate at the base, dark green above, paler

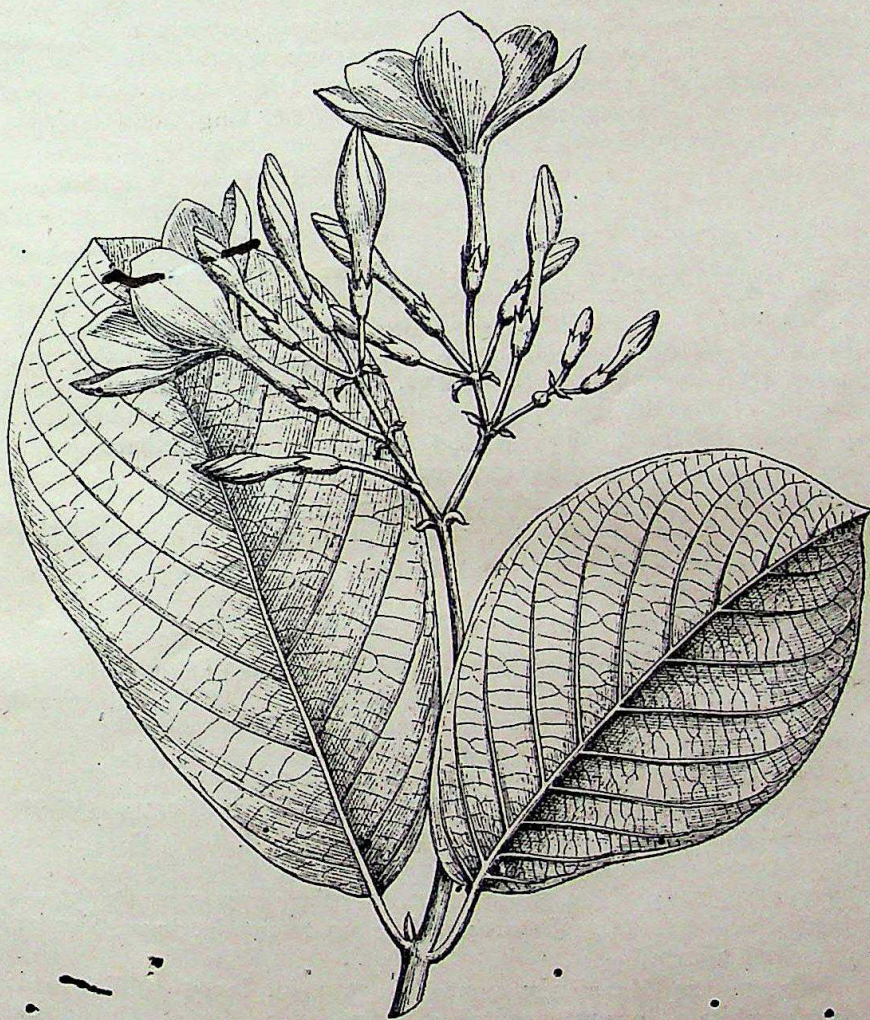


Fig. 1.—*Chonemorpha macrophylla* G. Don.  $\times 1$

beneath, almost hirsute below, sparsely hairy above, entire on the margins; petiole short, cylindrical.

Flowers borne in sub-terminal short-pedunculate cymes; branches cylindrical, green, speckled with red. Calyx tube .75 in.

long, cylindrical, shortly 5-lobed, at length withering red-brown and tightly embracing the base of the corolla tube. Corolla-tube white, narrow at the base, swelling above into a throat, about .75 in. long, ending above in five white petals which spread at right angles to the tube; lobes broadly obliquely triangular or trapezoid from a very narrow base, white, yellowish in the throat. Stamens five, inserted at the bottom of the throat. Disk 5-lobed. Ovary of two distinct carpels. Fruit of two long straight hard trigonous follicles 12-18 in. long. Seeds flat with a long tuft of hair.

*Flowers*.—May-July. Fruits cold season.

*Distribution*.—Throughout India 2,000-6,000 ft. extending to Burma, Malaya and Ceylon.

*Gardening*.—A large powerful climber with copious milky juice and very large leaves. The fragrant, pure white flowers, about 3 in. across, appear in great abundance during the hot weather. Propagation is by seed which is produced abundantly. It is suitable for cultivation in the open on a long trellis or on trees.

### Vallisneria Burm.

(This name is derived from the Latin word *vallis*, I enclose, owing to the fact that some species are used for screens in Java).

A genus of climbing shrubs with punctuate, opposite leaves. The white flowers are borne in dichotomous or fascicled cymes issuing from the axils of the leaves. Calyx 5-lobed, from a short tube. Corolla-tube short, with five petals. Stamens five, fixed to the top of the tube seated on short filaments; anthers acuminate and sagittate at the base, connivent at the apex into a cone, with a large gland on the connective. Disk of five scales or lobes. Ovary of two hairy carpels, at first connate, soon free. Fruit of two oblong acuminate carpels.

**Vallisneria Heynei** Spreng. [*Vallisneria solanacea* (Linn.) O. Ktze.].

(This plant was named in honour of Frederick Adolf Heyne, a German botanist who lived at the beginning of the nineteenth century).

*Description*.—A hoary, climbing shrub or creeping over the soil. Stems covered with a grey lenticellate bark, emitting a copious white latex when wounded. Leaves opposite up to 5 in. long by 2 in. broad, elliptic, oblong, acuminate, sometimes somewhat abruptly narrowed to the acute apex, membranous, cuneate at the base; nervation rather obscure; petiole up to .75 in. long, slender, channelled above.

Inflorescence of axillary cymes about 1 in. long, 3-6-flowered; flowers white, fragrant, seated on slender pedicels. Calyx-tube very short, 5-lobed; lobes up to 1 in. long, acuminate, thin, shortly ciliate on the edges. Corolla-tube about .3 in. long, narrow and cylindrical and hairy within below, campanulate above, ending in five petals, which are orbicular in shape, .25 in. long. Stamens five, inserted at the top of the narrow portion of the tube;

## SOME BEAUTIFUL INDIAN CLIMBERS AND SHRUBS . 455

anthers acuminate above, sagittate at the base; carrying a large horse-shaped appendage on the connective. Disk annular, 5-toothed. Ovary of two connate carpels. Fruit of two follicles, straight.



Fig. 2.—*Vallaris Heynei* Spreng.  $\times \frac{1}{2}$

*Flowers*.—December-April. *Fruit* January-April next year.

*Distribution*.—Native of India and Burma, often grown for ornament in gardens.

*Gardening*.—An extensive, vigorous climber, evergreen and drought-resistant, with small elliptic-ovate leaves. The creamy white, scented flowers are produced in profusion during December-April. It is an excellent plant for cultivation in the open on trellis, or arches or trees. Propagated easily by layering, cuttings, suckers or seed. It was brought into cultivation in Europe in 1818.

*Medicinal and economic uses*.—The bark is bitter and astringent and according to Haines is chewed by Kols for fixing loose teeth. The latex from the stem is applied to sores and wounds. According to Rev. Thompson it is believed to keep away snakes during the rains when it is suspended from the roof on a certain day in June.

**Strophanthus** DC. (*Roupellia* Wall. et Hook.).

(This generic name comes from two Greek words which mean *twisted cord* and *flower* and refer to the long, caudate petals of some species. The other generic name *Roupellia* was selected by Wallich and Hooker to commemorate the name of Charles Roupell of Charlestown, South Carolina, 'commemorated in many of the pages of Sir James E. Smith's Correspondence of Linnaeus'.)

This genus contains a number of shrubs, some of them are climbers. The leaves are opposite and penni-nerved. The inflorescence is terminal and consists of few-flowered cymes, compact, or many-flowered corymbs. Sepals five in number with 5-20 glands at the base. Corolla-tube short, campanulate in the throat, ending above in five petals which are more or less long caudate; throat with 10 scales inserted in pairs. Stamens five, attached to the top of the tube, included; filament short; anthers sagittate, more or less acuminate, connivent. Disk absent. Ovary of two distinct carpels; style filiform. Fruit of two follicles.

The seeds of the species of this genus are well known for the presence of an active chemical substance called *strychnine*. It raises the blood pressure, acts as a diuretic and is a powerful cardiac poison. Because of these properties different species have been used as arrow poisons in different parts of the world.

**Strophanthus gratus** Franch.

Cream-fruit.

(*Gratus* is a Latin word meaning pleasing).

*Description*.—A handsome, climbing, shrubby plant. Shoots green, terete, very glabrous. Leaves opposite, petiolate, stipulate, up to 6 in. long by 2 in. broad, oblong-elliptic or elliptic in shape, glabrous, entire on the margins, acute at the tip, cuneate at the base, dark green on the upper surface, paler below; nerves somewhat impressed on the upper surface, slightly prominent below, joined by an intramarginal vein; stipule short, awl-shaped; bases of the petioles joined by a stipular line.

Inflorescence terminal, of 6-8 white, rose-tinted flowers, crowded into a cyme. Bracts ovate-lanceolate, acute or acuminate, keeled on the back, .15-.2 in. long. Pedicels longer than the bracts but shorter than the calyx. Calyx of five lobes, each .6-.8 in. long, obovate in shape, obtuse, greenish but reddish at the tip. Corolla-tube swelling above, glabrous without and within, .5 in. long, ending above in five petals; petals broadly obovate in shape, crisped on the margins, under 1 in. long. In the mouth of the flower is a corona of 10 linear-lanceolate scales, connate at the base, erect, of a beautiful rose colour, .4-.5 in. long. Stamens five, inserted at the beginning of the swollen portion; filaments short, thick, slightly papillose; anthers produced above into a subulate process protruding from the corolla tube. Ovary surrounded by



Photo by

M. B. RAIZADA.

CREAM FRUIT  
*Strophanthus gratus* Franch.  
New Forest, Dehra Dun.



Photo by

CREAM FRUIT

*Strophanthus prunifolius* (Franch.)

M. B. RAZADA.

SOME BEAUTIFUL INDIAN CLIMBERS AND SHRUBS --

a nectariferous disk. Carpels distinct, joined by a filiform style; ovules numerous, on axile placentas.

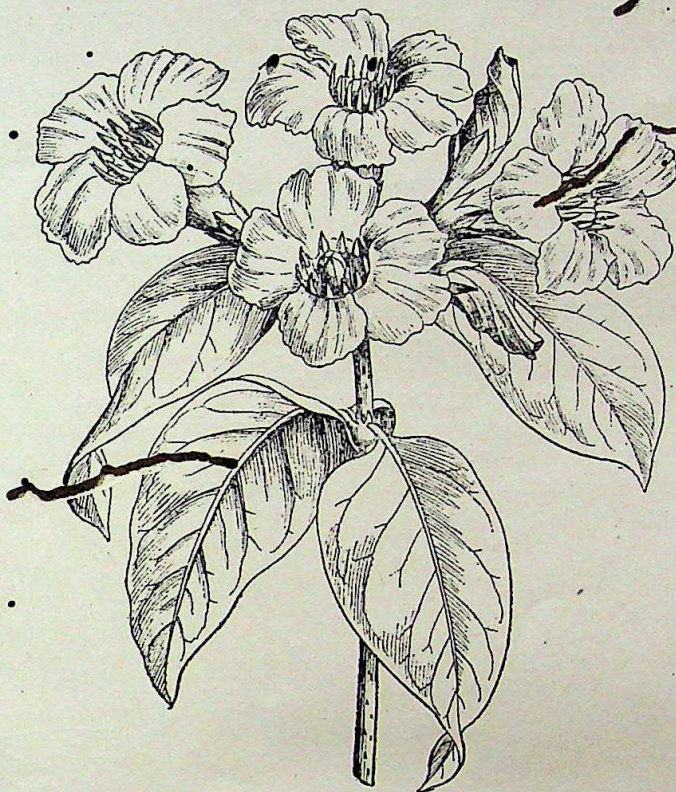


Fig. 3.—*Strophanthus gratus* Franch.  $\times \frac{1}{2}$

**Flowers.**—Hot and rainy season. **Fruits** cold season, but very rarely.

**Distribution.**—Native of Sierra Leone, tropical Africa, now in cultivation in all tropical and subtropical countries of the world.

**Gardening.**—A handsome, climbing, shrubby plant or a rambling shrub requiring considerable space for its full growth but it can be kept within bounds by judicious pruning. The large, leathery, bell-shaped flowers are white tinged with rose-purple and are attractive just as they are opening. As it is a fast grower it requires plenty of water during summer. Good fresh loam, with a little leaf-mould suits it best. It is well adapted for a trellis or to trail up a pillar or rafter. Propagated easily by cuttings which strike root readily during the rains. It is commonly known under the name of *Roupellia grata* in Indian gardens.

**Trachelospermum** Lemaire.

(This generic name comes from two Greek words, *trachelos*, a neck, and *sperma*, a seed. The combination refers to the long seed of the species.)

M. B. RAZADA.

CREAM FRUIT

*Strophanthus gratus* Franch.

A genus of climbing shrubs with opposite leaves. Inflorescence of terminal or axillary cymes. Flowers white or purple. Sepals 5, small, glandular or scaly at the base inside. Corolla-tube cylindrical, dilated at the insertion of the stamens, ending above in five spreading lobes. Stamens five, included in the tube, connate at the apex and connivent around the stigma. Disk annular, truncate, or 5-lobed. Ovary of two distinct carpels. Fruit of two dry follicles.

## KEY TO THE SPECIES.

Calyx-lobes erect  
Calyx-lobes reflexed

... *T. fragrans*.  
... *T. jasminoides*.

***Trachelospermum fragrans* Hook. f. [*T. lucidum* (Don)  
K. Schum.]**

*Description*.—An evergreen, twining shrub. Young shoots slightly hairy, emitting a milky juice when cut. Leaves opposite, up to 6 in. long by 2 in. broad, elliptic-lanceolate acuminate, glabrous, bright green above, paler below; petiole about 3-4 in. long, minutely hairy.



Fig. 4.—*Trachelospermum fragrans* Hook. f.  $\times 1 \frac{1}{2}$

Inflorescence a lax, terminal or axillary, trichotomous panicle? Flowers white, seated on glabrous pedicels decorated by minute bracts. Calyx about .1 in. long, cleft almost to the base, 5-lobed; lobes ovate, obtuse, ciliate. Corolla-tube about .4 in. long, very slender below, inflated at the top, glabrous within and without; mouth 5-lobed, hairy, 5-lobed; lobes spreading, cuneate below, obliquely truncate at the apex, overlapping to the right, twisted



Photo by

N. L. BOR.

HILL JASSMINE  
*Trachelospermum fragrans* Hook. f.  
New Forest. Dehra Dun.



N. L. Bor.

HILL JASMINE

Photo by

## SOME BEAUTIFUL INDIAN CLIMBERS AND SHRUBS

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to the left. Stamens 5, included; anthers connivent to the top of the style. Disk of 5 erect lobes. Carpels two, glabrous, distinct; style filiform; stigma columnar; ovules many in each cell. Follicles up to 12 in. long by .2 in. broad, incurved, cylindrical. Seeds .7 in. long, linear, flattened, dull-brown; coma copious, 1 in. long.

*Flowers.*—April-June. *Fruits* October-December.

*Distribution.*—North-West Himalayas 3,000-7,000, Assam, Cachar, and Upper Burma.

*Gardening.*—A tall climber with dark green leaves and white fragrant flowers which are produced in great abundance during the hot season. It is suitable for covering embankments and the like and prefers moist shady places. Propagation is by cuttings of half-ripened wood during the rains or by seed.



Fig. 5.—*Trachelospermum jasminoides* Lem.  $\times 1/1$

**Trachelospermum jasminoides** Lem.[*T. divaricatum* (Thunb.) K. Schum.].

Star Jessamine.

(The specific name *jasminoides* means jessamine-like in Latin).

**Description.**—A pretty, evergreen, climbing shrub; young parts pubescent. Leaves petioled, opposite, elliptic, elliptic-lanceolate or even oblanceolate in shape, glabrous and smooth, somewhat coriaceous in texture, entire on the margins, up to 2.5 in. long by 1 in. wide; petiole very short, grooved above.

Inflorescence a few-flowered cyme seated on a peduncle much longer than the subtending leaf. Flowers pure-white, very fragrant. Calyx divided almost to the base into five reflexed, lanceolate, ciliate segments .1-.2 in. long. Inside the calyx at the base of the corolla are several jagged scales. Corolla-tube .25-.3 in. long, abruptly contracted below the middle, glabrous outside, hairy within at the mouth, ending above in five lobes; lobes oblique, obovate-spatulate, spreading, waved, with reflexed margins. Stamens five, sessile on the corolla; anthers lanceolate; connective produced above into a spur, the whole five stamens cohering into a cone round and adherent to the stigma. Ovary of two carpels. At the base of the ovary are five large glands, two united, three free.

**Flowers.**—March-April. **Fruits** cold season.

**Distribution.**—Indigenous to China and Japan, commonly grown in gardens throughout the country.

**Gardening.**—A pretty, white-flowered, evergreen climbing shrub with deep green, smooth foliage. The delightfully fragrant flowers are produced in great profusion during the early part of the hot weather. It is well suited for growing over a trellis. It was collected by a Mr. Fortune from Shanghai and introduced by him into European gardens. Propagation is by cuttings or layers during the rains. It is best suited for pergolas, arches and the like.

**Melodinus** Forst.

Climbing shrubs. Leaves opposite, pinni-nerved; nerves parallel. Inflorescence terminal of trichotomous panicles, many-flowered or axillary and then few-flowered; flowers white, often fragrant. Calyx of 5 sepals, without glandular scales. Corolla-tube dilated at the insertion of the stamens, ending above in five twisted petals; throat of the corolla furnished with scales. Stamens five, inserted towards the base or in the middle of the tube. Disk absent. Ovary entire, bilocular, style short; stigma thick; ovules numerous. Fruit globular, pulpy, containing many seeds.

**Melodinus monogynus** Roxb.

(*Monogynus* means with a single ovary).

**Description.**—A large, glabrous, scandent shrub. Branches and branches at first green, afterwards turning brown, containing copious quantities of latex. Leaves opposite, petiolate, up to 6 in.

## SOME BEAUTIFUL INDIAN CLIMBERS AND SHRUBS

long, elliptic, elliptic-oblong or oblong-lanceolate, acuminate, glabrous and smooth, chartaceous in texture; margins incurved; petiole .2-.4 in. long.



Fig. 6.—*Melodinus monogynus* Roxb.  $\times \frac{1}{2}$

Inflorescence close, terminal, of trichotomously branched panicles; branches puberulous, rather thick. Flowers white fragrant. Calyx of five sepals, elliptic-obtuse, elliptic-oblong or even ovate, ciliate on the margins, .1-.15 in. long, imbricate. Corolla-tube .7 in. long, tubular below becoming funnel-shaped above, glabrous without but hairy within, ending above in 5 lobes; lobes spreading, up to .5 in. long, oblong or ovate, obtuse; corona of scales present, five in number, villous, bifid at the apex. Stamens five, filaments very short; anthers without basal appendages. Disk absent. Ovary of two connate carpels. Fruit a globose berry, smooth, yellow or orange in colour, up to 3 in. in diameter.

*Flowers.*—April. *Fruits* cold season.

*Distribution.*—Native of Sylhet and Assam extending to Malaya Peninsula and China. Occasionally cultivated in gardens throughout the plains and up to 4,000 ft. in the hills.

*Gardening.*—A large climber with milky juice and bright dark-green, lanceolate leaves. The pure white, very fragrant flowers are produced during spring and make this plant very ornamental. The fruit which is the size and colour of an orange is said to be edible. Propagation is by seed, cuttings or layers during the rains. It was introduced into England by Capt. Craigie as a present from Dr. Wallich of the Calcutta garden. It is well suited for growing over arches, pergolas and the like.

(To be continued).

# MATERIALS FOR THE ORNITHOLOGY OF AFGHANISTAN.

BY

HUGH WHISTLER (Deceased).

## PART V

[Continued from Vol. 45, No. 3 (1945), p. 302].

### *Columba palumbus casiotis* (Bonaparte).

Specimens collected.—sex? Bharawal (Griffith); ♂ 15 March 1879 Kandahar (St. John); ♀ 22 April 1879 Byan Khel (Wardlaw-Ramsay); ♂ 22 Oct. 1934 Ashraf 4,000 ft. (Maconachie).

Wardlaw-Ramsay found the Eastern Woodpigeon in the Hariab Valley 7,000-8,000 ft. in flocks varying from ten to fifty individuals. Throughout April a large flock could always be found in the pine-forest between the main range of the Safed Koh and the village of Ali Khel. These paired by the middle of May and several nests were found.

According to his Journal, Griffith's specimen was obtained at Bharawal on 7 March 1840.

St. John and Swinhoe say that the Woodpigeon is very common in the large gardens about Kandahar.

### *Columba oenas* Linnaeus.

Specimens collected.—♂ 2 ♀ 28 Nov. 1884 Karabagh (Aitchison).

These, the only records of the Stock-Dove in Afghanistan, suggest that it is a winter visitor.

### *Columba eversmanni* Bonaparte.

Specimens collected.—sex? Bharawal Soorgunge near Chughur Serai (Griffith); 2 ♂ 3 ♀ 22-23 April 1885 Tirphul, 2 ♂ 28 April 1885 Tomam-agh (Aitchison); sex? 1 June Min Darakht, Maimanah (Yate); 2 ♂ 2 ♀ 7-10 May Danaghori 2,300 ft., 2 ♂ 20 May 1937 Kunduz 1,400 ft. (Meinertzhagen).

Commenting on his series of Eastern Stock-Doves in the above list, Aitchison says that they were nesting in trees in the bed of the Hari-Rud river in considerable numbers. Meinertzhagen first met with this bird at Danaghori where it was quite common, often feeding in the cultivation and marsh-land with the Rock-Pigeon but segregated in its breeding area, the groves of mulberry and old stubs. Birds were flushed from holes in the trees and their organs were ripe for breeding in the second week of May. They were common also at Haibak but outnumbered by the Rock-Pigeon. At Kunduz they were common and breeding, the Rock-Pigeon being then in a minority. At Kunduz they were breeding also in ruined buildings. Six out of fifteen birds shot by Meinertzhagen's party had had their tails recently pulled out, the new feathers being then in growth.

In Seistan, Cumming only saw a single specimen and that he procured at Kuhak on 28 April 1905.

### *Columba livia gaddi* Zarudny & Loudon.

Specimens collected.—♀ Khorsa (Griffith); ♀ 30 Dec. 1880, ♀ 4 Jan. 1881, 2 ♂ 20 March 1881 (Swinhoe); juv. 30 Jan. 1881 Kandahar (St. John); sex? 22 Feb. Chahar Shamba (Yate); sex? December Lab-i-Baring, ♀ 22 April 1905 (Annandale); ♂ 27 August 1933 Logar 5,700 ft. (Maconachie); ♂ 16 April Ghorband 9,000 ft., ♂ 19 April Balula 8,000 ft., 2 ♂ 20 April Bamian 9,000 ft., ♂ 26 April Akrobat, 3 ♂ 2 ♀ 12 May 1937 Haibak 3,000 ft. (Meinertzhagen).

The hybridisation of the Blue Rock-Dove with the domestic pigeon appears to have reached its apogee in Afghanistan and all writers comment on this

fact and the varieties of plumage to which it gives rise. Wardlaw-Ramsay found them common in the Hariab Valley 7,000-8,000 ft. in May and June and attributes their great variation of plumage to hybridisation. Yate (Northern Afghanistan, p. 46) has the following interesting note:—'The nearer one gets to Herat the thicker the pigeons become and the villages round the city simply swarm with them. The fields are alive with flocks but woe to the man who shoots them as they are all considered private property and a regular source of income. The round towers at the corners of the villages are generally made into pigeon houses in addition to the regular square-built pigeon towers that one sees dotted about the country. The birds have to be fed throughout the country or otherwise they go off to a more hospitable place as it is the object of every owner to tempt as many birds as possible to take up their residence in his particular tower for the breeding season. A large tower, it is said, will produce as much as 15 kharwars (1 kharwar=10 maunds Indian) of manure in a year and the ordinary round bastion-shaped tower at the corner of a village produces at least 6 or 7 kharwars. Each kharwar sells at the rate of 15 krans or 6 rupees.'

The Rock-pigeon is found in Seistan (Cumming) and St. John notes that enormous flocks occur everywhere at Kandahar in winter. They commence nesting early in March. Both St. John and Swinhoe discuss the variations in plumage and their connection with tame stock.

The above summary was written before Meinertzhagen's account appeared with which it has little agreement. He says that domestic pigeons are not very usual in Afghanistan and he saw no evidence of feral birds. His account of what he considered truly wild stock is as follows:—'The Rock-pigeon is apparently resident throughout Northern Afghanistan up to at least 9,000 ft. in suitable localities. At Danaghorī they were in about equal numbers with *Columba eversmanni*, at Haibak the latter was in a minority, but at Kunduz *eversmanni* predominated. They were often in small mixed parties and did not appear to compete one with another. Though *eversmanni* occasionally nests in banks and buildings (never in cliffs), the usual nesting site is a hole in a tree, a situation never used by Rock-pigeons.

The largest colony of Rock-Pigeons we saw was at Bamian, where they had taken advantage of human excavations and were breeding in numbers on the Buddhas and in the rock-dwellings.'

The two accounts, of course, refer to different areas and are divided by a number of years so there is not much point in discussing how they may be reconciled. Both grey-rumped and white-rumped birds occur throughout the country. Afghan birds have hitherto been attributed to *intermedia* or *neglecta* but Meinertzhagen who has had the best series for examination attributes his specimens to the Persian race *gaddi* and Swinhoe's and St. John's specimens which I have seen would I think pass as that form.

#### ***Streptopelia turtur arenicola* (Hartert).**

Specimens collected.—2 ♂ 1 ♀ 12 May 1885 Khusan (Aitchison); sex? 2 July Chilik, Afghan Turkestan (Yate); ♀ 4 July 1933 Ashraf Valley 3,700 ft. (Maconachie); 2 ♂ 1 ♀ 8 May Danaghorī 2,300 ft., ♀ 20 May 1937 Kunduz 1,400 ft. (Meinertzhagen).

Aitchison states that the Common Turtle-dove suddenly arrived on the Hari-Rud in large flocks about 12 May. Meinertzhagen first met with them at Danaghorī on 8 May where they were common and had just arrived. By 10 May, they were still more abundant and pairs were courting and evidently preparing to breed. They were equally abundant at Haibak and Kunduz from the second week in May and on the return journey they were common at Doshi on 22 May. Maconachie obtained a female in the Ashraf Valley on 4 July 1933.

This Turtle-dove evidently does not breed in Southern Afghanistan as the only record is afforded by a specimen Colonel Swinhoe is said to have obtained at Kandahar. I have not been able to trace it.

#### ***Streptopelia orientalis meena* (Sykes). [= *ferrago* auct.].**

Specimens collected.—sex? 23 May, ♂ 5 June 1879 Bikaner (Wardlaw-Ramsay); 2 ♂ 1 May Doshi 2,750 ft., ♂ 13 May Haibak 3,000 ft.; ♂ 24 May 1937 Ghorband 8,300 ft. (Meinertzhagen).

First met with at Doshi, when four birds were seen feeding on fallow land. Their organs were ripe for breeding. Again at Haibak on 12 May a single pair was found in the mulberry orchards, another pair at Baghlan on 18 May and several pairs were found breeding in the Ghorband Valley at about 8,000 ft. on 24 May where they were absent in mid-April (Meinertzhagen).

Apart from the above records, which incidentally confirm the correctness of keeping *orientalis* and *turtur* as separate species, the Eastern Turtle-Dove is only recorded from the Sufed Koh where Whitehead says it is common in summer in the woods from 7,000 ft. to tree limit. There Wardlaw-Ramsay says they arrived at Byan Khel 7,000 ft. in large numbers between 12 and 26 May.

***Streptopelia senegalensis ermanni* (Bonaparte).**

Specimens collected.—2 ♂ 14 May 1937 Haibak 3,000 ft. (Meinertzhagen).

Meinertzhagen met this race of the Little Brown Dove at Haibak where it was breeding in buildings in mid-May. He also observed it at Kunduz on 20 May, where there were a few about the old ruined town.

***Streptopelia senegalensis cambaiensis* (Gmelin).**

Specimens collected.—♂ 10 March 1879 Kandahar (St. John); ♂ ♀ 19 March 1881 Kandahar (Swinhoe); ♀ 11 June 1933 Logar 5,700 ft. (Maconachie); ♂ 31 May 1937 Jalalabad (Meinertzhagen).

Meinertzhagen found the Little Brown Dove breeding commonly at Jalalabad on 31 May, on which day a nest with eggs was found. He also observed it as far west as Nimla; and Maconachie obtained it at Logar on 11 June. It is presumably a resident in this area as it is in Southern Afghanistan where St. John and Swinhoe found it common. It commences breeding at Kandahar in the latter end of February and is very common in the city, nesting in holes in the mud walls.

***Streptopelia chinensis suratensis* (Gmelin).**

Nobody has obtained a specimen of the Spotted-dove in Afghanistan but it is recorded by Hutton who says it is common during the summer at Kandahar. Meinertzhagen observed it at Nimla and Jalalabad on 31 May but says it was not common.

***Streptopelia decaocto decaocto* (Frisch).**

Specimens collected.—2 sex? Chughar Serai, sex? Khursak, 2 ♂ Kabul, sex? Kandahar (Griffith); ♂ 7 May 1879 Kandahar (St. John); ♀ 15 Dec. 1880, ♀ 14 April 1881 Kandahar, 2 ♂ 1 May 1881 Gungazai (Swinhoe); ♂ 7 May 1905 Khwaja Ahmed (Cumming); ♂ 17 May 1933 Kabul (Maconachie).

Wardlaw-Ramsay found the Indian Ring-dove not nearly as abundant as *S.d. meena* in the Hariab Valley 7,000-8,000 ft. He first observed it there on 10 June. At Kandahar, according to Swinhoe, it is common throughout the year, avoiding the city and being found in the surrounding gardens. Nests were being built in April. It must be fairly widely distributed in the country, as besides the localities provided by the above listed specimens, Meinertzhagen found a pair breeding in the Legation garden at Kabul on 25 May. He also observed it on the Upper Kabul River near the Unai Pass at about 7,000 ft. in late May and breeding at Jalalabad on 31 May.

***Oenopelia tranquebarica* (Hermann).**

Meinertzhagen observed several Red Turtle-Doves in the hotel compound at Jalalabad on 31 May. Doubtless a summer visitor.

***Pterocles orientalis* (Linnaeus).**

Specimens collected.—♂ Subzeekote, ♀ Afghanistan, ♂ 13 July 1839 Gohaur, ♀ 25 Oct. 1839 Kalail (Griffith); ♂ April 1879 Kandahar (St. John); 2 ♂ 1 ♀ 2-20 Jan. 1881 Kandahar (Swinhoe); ♀ 3 Nov. Kin, ♀ 5 Nov., ♂ 6 Nov. Kagin, ♂ 9 Nov. 1884 Karez dasht, ♀ ♀ 12 March 1885 Gulran (Aitchison); sex? 1896 Shorawak (Maynard).

The earliest record of the Imperial Sandgrouse in Afghanistan is provided by Vigne (p. 110) though I cannot quite identify his locality. About 12 June

1836 he was on the plain of Suliman Khel between Ser-i-Koh and Dsharahi Ridge and relates how his party frequently disturbed the *boora korra* (black-breast) or large Sandgrouse with its gurgling cry. These birds afforded him good sport to the delight of the Lohanis many of whom had never seen anything killed with shot before. These birds must have been on their breeding ground and it is clear that this species is widely distributed as a breeding bird in Afghanistan. As regards South-east Afghanistan, St. John says that a few remain to breed, and Swinhoe adds that they commence pairing early in March, eggs being said to be laid about the middle of April. This is supplemented by C. H. T. Marshall (*Stray Feathers*, vol. viii, p. 492) who says that he has just heard—possibly from St. John—that *P. arenarius* was found breeding in numbers on the Wuzeer Korey plain, about 10 miles from Kandahar. No eggs were taken as the discoverers did not wish to disturb the birds.

In North-west Afghanistan Aitchison and Yate (p. 45) found them breeding in pairs all over the plains in May and June, the nest being a mere hollow scratched in the ground by the side of a tuft of wormwood. Yate remarks on the excellence of the young birds for the table.

It would seem, however, that the Imperial Sandgrouse is found in greater numbers as a winter visitor or passage migrant. Swinhoe says they are found in the Kandahar area throughout the year, but St. John says that the majority of the immense flocks seen in winter move northwards in the spring.

In the North-east, Yate (p. 45) under 14 Sept. 1885 at camp Robat-i-Afghan says that the Sandgrouse are now appearing in regular flocks and Aitchison also speaks of them occurring in large flocks during autumn and spring.

Koelz (*Proc. Biol. Soc. Washington*, vol. 52, p. 81) would separate Afghan birds as *Pterocles orientalis bangsi*.

#### *Pterocles alchata* (Linnaeus).

Specimens collected.—♀ Afghanistan (Griffith); 2 ♂ 18 June, 3 ♀ n.d. Kham-i-ab, Afghan Turkestan (Yate).

Under the description of the 'white-breasted pintail Sandgrouse' Yate mentions meeting the Large Pin-tailed Sandgrouse at Khusan on 12 Oct. 1885 and in May in the desert that lies between Andkhui and the Oxus. In the latter area he says he used to see them coming to drink in small numbers wherever a few inches of mud and water were left. As Yate's specimens were obtained in June it seems safe to assume that this Pin-tailed Sandgrouse breeds in Afghan Turkestan.

St. John considered that it bred in the desert between the Helmund and Kandahar as he met it there in July. He says it is more of a desert form than *arenarius* and in consequence not so generally distributed. At Kandahar Swinhoe says several flocks were about for a week or ten days about Christmas time. He killed five from a passing flock about half a mile in front of the Idghar Gate.

#### *Pterocles coronatus atratus* Hartert.

Specimens collected.—2 ♂ Bassoolah 1,500 ft. (Griffith); ♂ 1896 Shorawak (Maynard).

St. John says that the Coronetted Sandgrouse is the only small Sandgrouse of Southern Afghanistan where it is very generally distributed though nowhere numerous. It is commonly seen in small parties of six or so and is more active on the ground than other sandgrouse, running about and picking up seeds like a partridge in contrast with the staid and leisurely movements of *arenarius* and *alchata*. It evidently breeds in the Helmund desert for he found it common between Kandahar and the river in July.

There is no record of it out of this area.

#### *Pterocles senegallus* (Linnaeus).

Specimens collected.—♂ 11 March 1896 Lijjika 2,400 ft. (Maynard); ♀ 21 Dec. 1918 Lutak Road, Seistan, 1,600 ft. (Annandale & Kemp).

According to Cumming this is said to be the common sandgrouse of Seistan and Annandale & Kemp's bird, which I have been able to examine through the courtesy of Dr. Baini Prashad, is certainly a specimen of the Spotted Sandgrouse though it was recorded as *Pterocles arenarius caudacuta* (sic).

[It is not clear whether the Common Sandgrouse (*Pterocles senegalensis elphoti*) actually occurs in Afghanistan. Hutton certainly says that it is common throughout the southern parts of Afghanistan and that he has seen their nests in August and the young ready to fly by the end of September, but this seems to have been due to confusion with some other species.

It is useless speculating as to the identity of the pair of sandgrouse Wardlaw-Ramsay saw flying over the camp in the Hariab Valley 7,000-8,000 ft. at the same hour in the same direction on three successive evenings.]

***Pucrasia macrolopha castanea* Gould.**

Specimens collected.—2 ♂ 3 ♀ Kafaristan.

According to Griffith's Journal the Koklas was brought in to him at Bala Chughar Serai on 9 March 1840.

I can trace no other information about this pheasant in Afghanistan and the above types are, so far as I know, the only specimens at present existing in any collection.

***Phasianus colchicus principalls* Selater.**

Specimens collected.—2 ♂ 3 ♀ 29 Dec. 1884, 2 ♂ 3 Feb. 1885 Balamorghab, 1 ♂ 2 ♀ 15 Feb. 1885 Karawal Khana, Badghis (Aitchison); ♂ 10 Feb. Chahar Shamba, ♂ 10 March ♂ 20 March ♀ 26 March ♀ 25 March Maruchak, Murghab (Yate).

The first example of this pheasant to reach the notice of a scientist was probably the mutilated specimen sent to Hutton (p. 782) from Herat by Lieut. North of the Bombay Engineers. It was recorded by Blyth under the name of *Phasianus colchicus* and from his description appears to have been an old or barren female in partial male dress.

It remained however for the officers of the Boundary Commission to collect a good series of skins on which the bird was separated as a distinct species by Selater. The Commission found that the pheasant was extraordinarily numerous in north-west Afghanistan in the swampy tamarisk and grass jungles of the river beds—jungles where the tiger and the wild pig were also found. Kuhsan and Tomam-agma on the Hari-Rud; Kara Tepi in the Kushk Valley; Maruchak, Shukar-Gujar, Karawal Khan, Chahar Shamba, Bokum and Kila Wali, all in or near the Morghab Valley; and Chashm-i-Sher near the Chahar Dar Pass of the Hindu Kush—all these are localities where the birds were found as described by Yate in his 'Northern Afghanistan or Letters from the Afghan Boundary Commission' (pp. 45, 59, 102, 112, 124, 125, 129, 207 and 326) where a good idea is conveyed of the habits and habitat of the bird. It was then sufficiently numerous for 72 birds to be bagged in the best days shooting and more than 400 were killed in the march of 30 miles up the Morghab.

The breeding season is fairly early as Yate states on 2 April that the pheasants were then all breeding, the hens having begun to lay a month previously. It is curious for English readers to learn of this species that 'it not only wades through the water in trying to make from one point of vantage to another, but swims, and seems to be quite at home in these thickets, where there is always water to a depth of two or three feet'. Morning and evening the pheasants fed on the more open and dry country around. The local method of riding down the birds on horseback in the snow and catching them by hand is described by Yate.

***Phasianus colchicus bianchii* Buturlin.**

Specimens collected.—9 ♂ 8 ♀ 4-9 May 1937 Danaghor 2,300 ft. (Meinertzhagen).

This pheasant was only met with in the marshes in the Danaghor Plains. They also occur at Kunduz in similar country, but probably have no intermediate station owing to lack of suitable country. Birds were laying in the first week of May. . . . The Danaghor pheasants roost and spend the heat of the day in the extensive reed-beds, coming out to water-meadows and crops in the morning and evening. If flushed they at once make for the reeds, and if they find one between them and the marshes they fly back over one's head. Nothing will drive them from their home'. (Meinertzhagen).

This series was identified by Meinertzhagen after comparison with typical material in the Leningrad Museum.

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*Note.*—Three pheasants of the *colchicus* group are in the Maconachie collection. Unfortunately they were evacuated from the British Museum before I had examined them or ascertained the data.

**Lophophorus impejanus** (Latham).

The Monal Pheasant according to Whitehead is fairly numerous on the Sufed Koh from 9,000 ft. to tree-limit. So Wardlaw-Ramsay's informants were right who told him that they had seen the birds on the Safed Koh and the Peiwar Range and that they were plentiful.

Whitehead met young fairly strong on the wing on 27 July.

In 1840 Griffith notes in his Journal that the Monal is not uncommon on all the hills about Bala Chughur Serai, the local name being *Moorgi Zureen*.

**Coturnix coturnix coturnix** (Linnaeus).

Specimens collected.—2 ♂ 26-27 April Tomam-agma, Hari Rud, ♀ 4 May Tirphul, Hari-Rud, ♀ 21 May 1885 Sang-haji, Badghis (Aitchison); ♂ 4 April Chahar Shamba (Yate); ♀ 19 April Karawal Khana, Murghab, ♂ 6 May Chahar Shamba (Yate); ♀ 22 Sept. 1904 Kuhak (Cumming); ♂ ♀ 4 May 1934 Bagram (Maconachie); 3 ♂ 22-26 May-April 1937 Bamian 8,500 ft. (Meinertzhagen).

The Common or grey Quail seems to be fairly generally distributed as a breeding bird in Afghanistan. Aitchison says a very few pairs were met with all over Badghis. St. John says they breed in small numbers in cornfields in the Kandahar Kuhak 30 March (1 egg), and Kila-i-Konah on 25 April (10 eggs). Cumming Province. Cumming mentions nests found in 1904 at Zahidan 22 March (1 egg), also implies that a few are found in Seistan in winter. In the main however the bird is evidently a spring and autumn passage migrant evidently in considerable numbers. The spring passage takes place in March, April and May. At Kandahar the Quail arrives in the middle of March according to Swinhoe or the end of March according to Hutton. At Bharawal in 1840 Griffith notes their arrival on 26 April in his Journal. In the north Meinertzhagen did not observe Quail until the night of 20-21 April at Bamian 8,500 ft. when numbers arrived and the local population turned out to noose them. He noted another large influx on 26 April but no more were seen, save for a single bird at Haibak on 15 May.

There is little information about the autumn passage save that it takes place in September and October. Griffith mentions Quail in his Journal as abundant at Bamian from 3 to 6 September, at Zohwak on 6 September, abundant at Kurzar 10 September at the Sorkhab River on 9 October and as scarce at Sultanpur on 20 October.

Quail are commonly kept by Afghans for fighting and in the spring nearly every man and boy is seen with one or two about him, often dancing the bird up and down on the hand to strengthen its legs.

**Alectoris graeca** (Meisner).

Specimens collected.—2 sex? Bala Chughur Serai (Griffith); 3 ♀ 17 Nov. Khusan, Hari-Rud, ♂ 28 Nov. Kar-o-bagh, ♂ 16 Dec. 1884 Bala Morghab (Aitchison); ♂ 1896 Khwaja Amran (Maynard); ♂ 27 August 1933 Logar 5,700 ft. (Maconachie); ♀ 11 April Tangi Gharo, Kabul 5,500 ft., ♂ 16 April Ghorband 6,000 ft., ♂ ♀ 27 April Dar-e-shikari 8,200 ft., ♀ 22 April 1937 Bamian 10,200 ft. (Meinertzhagen).

The Boundary Commission found the Chukor very numerous and in large coveys all over north-west Afghanistan from Khusan to Bala Morghab; and Yate (p. 56) gives an appreciative picture of the sport to be obtained when a pack of a hundred or more had been broken up in suitable cover in the bed of the Hari-Rud. He describes the Iskar Valley of the Hindu Kush as similarly swarming with chukor. These numbers have now no doubt been reduced with the general introduction of fire-arms but the bird is apparently still common. Meinertzhagen says it occurs in suitable country round Kabul north to Ghorband, Bamian and Doab but not much further north in spring and summer. In winter it descends and is then common at Doshi, Danaghori and Haibak though it does not seem to breed much below 5,500 ft.

Further to the north-east in Wakhan, Biddulph found the Chukor especially abundant in the valley between Panjah and Sarhad and the local people were then accustomed to hawk them.

The bird is also found in the hills of the south-eastern border and Whitehead says it occurs up to at least 8,000 ft. on the Safed Koh.

Meinertzhagen says birds were laying at the end of May in Afghan Turkestan and Wardlaw-Ramsay obtained a nest in the Hariab Valley on 16 June.

I am not fully satisfied as to the identity of Afghan Chukor and it may well be that more than one race occurs within the political boundaries. Meinertzhagen attributes his series to the race *falki* and Biddulph calls the Wakhan birds *pallidus*, while it seems probable that birds from the south-east should belong to the Persian and Baluch race *koraiakovi*.

***Ammoperdix griseogularis griseogularis* (Brandt).**

Specimens collected.—♀ Bala Chughur Serai (Griffith); ♂ 29 May 1879 Kandahar (St. John); ♀ 5 January 1881 Kandahar (Swinhoe); ♂ 8 Nov. 1884 Karez-dasht (Aitchison); ♂ 10 March 1896 desert near Gazechah 2,500 ft. (Maynard); ♂ 5 July 1933 Asraf 3,700 ft. (Maconachie); 2 ♀ 16-17 May Haibak 3,000 ft., ♀ 22 May 1937 Barfak 3,000 ft. (Meinertzhagen).

In his Journal, Griffith says he found the Seesee very common at Jagdulluck and very abundant at Gundamak and he also met it at Futtchabad and Bala Chughur Serai. It is now probably less common in those localities as Meinertzhagen found it decidedly scarce in Northern Afghanistan. In addition to the three specimens procured he only saw a pair at 10,000 ft. in the Bamian Hills on 24 April and another bird at Doab 5,000 ft. on 28 April. Aitchison says the most northerly locality at which he saw it was at Mont Do-Shakt near Kilki.

To the south-east it is found in broken and rocky ground by the hills of the Kandahar area and it was recorded as common by Hutton, St. John and Swinhoe.

Meinertzhagen's specimens were breeding in May.

***Francolinus francolinus henrici* Bonaparte.**

Specimens collected.—♂ Kandahar (Griffith); ♀ 26 Oct. between Padda-Sultan and De-Kamran, ♂ 27 Oct. 1884 between De-Kamran and De-Doda Aitchison; ♀ juv. August 1904 Kuhak (Cumming).

Swinhoe says that a few Black Partridges are to be found in the gardens near Kandahar and one day he shot five over an Irish Setter. He heard the characteristic call at Kokeran on the River Argundab. St. John says it is found in suitable localities throughout the Kandahar province up to 4,000 ft., being very numerous in the tamarisk jungles of the Helmund and among the dwarf palms of That Chotial. Throughout Seistan it is—or was in Cumming's day—an extremely common bird in the extensive tamarisk jungles which cover the banks of the numerous streams. Bags of 28 brace and 22½ brace were killed by Major T. W. Irvine and Capt. R. C. Bell who were with the Mission. Eggs were obtained at Kuhak in April, May and June.

The only specimen I have been able to examine from South Afghanistan is Griffith's Kandahar bird which in my opinion agrees with *F. f. henrici*. Hutton remarks on a Kandahar specimen as pale and so does Annandale with reference to Cumming's Kuhak bird. Ticehurst would however assign these birds to *F. f. bogdanowi* (Zarudny).

The only other area where the Black Partridge is recorded is between Padda-Sultan, De-Kamran and De-Doda. Here numbers were shot by Aitchison's party but only two were preserved. I have examined the De-Kamran specimen which is in the British Museum and consider it very close to *henrici* though the underparts are very pale and lightly marked showing transition to *arabistanicus*.

***Tetraogallus himalayensis himalayensis* Gray.**

Specimens collected.—Sex? Afghanistan (Griffith); sex? 7 Oct. Dhap Darah, Hindu Kush (Yate); ♀ June 1933 Paghman Range (Maconachie); ♀ 21 April 1937 Bamian 10,500 ft. (Meinertzhagen).

The Griffith specimen may have come from Topehee 9,000 ft. where he mentions the species under the date 2 Sept. 1840 in his Journal. Meinertzhagen

says two Snowcock were seen hanging in a shop in Kabul on 13 April. They were said to have been killed in the Paghman Hills. In the Ghorband Valley they were heard at 10,000 ft. in mid-April and at Bamian, south of the village, there were a few at between 9,000 and 12,000 ft. in April. Birds were breeding in the third week in April for the bird he shot had a fully-formed shell-less egg almost ready for laying.

Yate (p. 330) relates how the Hindu Kush specimen was caught by a Sowar under a rock where they had seen it take refuge from the pursuit of an eagle. Maconachie's bird was brought alive from the Paghman Range.

The Snowcock also occurs on the Safed Koh where Whitehead found it from about 9,000 ft. to the summit in summer though it was rather scarce.

#### *Rallus aquaticus korejewi* Zarudny.

Specimens collected.—♂ 20 Oct. 1884 between Lundi and Rudbar, ♂ 10 Jan. 1885 Bala Morghab (Aitchison); sex? 23 Dec. Maruchak, Morghab (Yate); ♀ 10 April 1937 Kabul (Meinertzhagen).

The above specimens provide the only records of the Water Rail in Afghanistan.

#### *Crex crex* (Linnaeus).

Specimen collected.—sex? 7 May Maruchak, Murghab (Yate).

Blyth states, apparently on the authority of a Captain Duncan who brought specimens, that the Land-Rail is a common summer visitor to Afghanistan but this presumably applies to the north only.

#### *Porzana porzana* (Linnaeus).

Specimens collected.—♂ 10 March 1881 Kandahar (St. John); sex? 9 April Karawal Khana, Murghab, sex? 30 April Chahar Shamba, Maimanah (Yate); ♀ 4 May 1937 Danaghoori 2,300 ft. (Meinertzhagen).

In addition to the above records, Blyth says that Barnes procured the Spotted Crake at Kabul and Hutton that it was shot at Kandahar.

#### *Porzana parva* (Scopoli).

Specimens collected.—♀ 7 Feb., ♀ 17 Feb., ♂ 18 Feb. 1881 Kandahar (Swinhoe); ♀ 6 Sept. 1904 Kuhak (Cumming).

According to Swinhoe and St. John, the Little Crake is common about the Kandahar marsh and the wheatfields on its borders about February. Cumming's Kuhak specimen was identified by Annandale with some hesitation.

#### *Porzana pusilla pusilla* (Pallas).

Specimens collected.—♀ 10 Feb., ♀ 17 Feb. 1881 Kandahar (Swinhoe); ♂ 7 Oct. 1884 between Gaz-i-cha and Safia (Aitchison); 2 sex? 24 April Kila Wali, Murghab (Yate); ♂ 5 April Chaharasia 5,700 ft., ♀ 7 Sept. 1933 Rahkol (Maconachie); ♀ 10 April 1937 Kabul (Meinertzhagen).

The above records supply our information about the Eastern Baillon's Crake in Afghanistan except that Swinhoe says that it is numerous about the Kandahar marsh where Hutton also mentions it.

#### *Gallinula chloropus indicus* Blyth.

Specimens collected.—sex? Kabul (Griffith); ♂ 7 April 1879 Kandahar (St. John); sex? Band-i-Seistan (Cumming).

Griffith mentions the Moorhen in his Journal at Shah Bagh on 24 July 1841. It evidently is not common though Blyth mentions it at Kabul, Hutton says it was shot at Kandahar in winter and Meinertzhagen says that it was often heard in the marshes at Danaghoori in May.

#### *Porphyrio poliocephalus* (Latham).

Specimens collected.—♀ 13 March 1881 Kandahar (Swinhoe); 2 sex? Nov. 1934 near Kabul (Maconachie).

The main stronghold of the Purple Coot in Afghanistan is in the dense reed-beds of the Naizars of Seistan where it is numerous though seldom seen. Cumming obtained some live specimens which took kindly to captivity and

lived with the chickens belonging to the Mission boatmen; and Swinhoe also mentions a tame bird which lived in the transport square at Kandahar all the winter. Meinertzhagen says that a few birds are shot in the winter round Kabul by sportsmen out after snipe.

***Fulica atra atra* Linnaeus.**

Specimens collected.—♂ 22 Feb. 1879 Kandahar (St. John); ♂ 4 ♀ 17-26 Feb. 1881 Kandahar (Swinhoe); sex? 29 March 1885 Kalla-i-Maur, Badghis (Merk); sex? March Andkhui (Scully); ♂ ♀ 9 Dec. 1918 Lab-i-Baring 1,600 ft. (Annandale).

The Coot is very abundant in enormous flocks in the reed-beds of the Naizars and the Hamuns of Seistan, according to both Cumming and Annandale. It is resident and Cumming took three clutches of eggs near Adimi on 14 March 1904. Large numbers are caught for food in nets stretched across channels in the reed-beds. These nets are hung on sticks stuck in the mud, the lower edge being in the water and the upper edge about 2 ft. above the surface. The flocks are driven into the nets with the aid of rafts.

Elsewhere the Coot seems to be a winter visitor or passage migrant, being particularly common in the reedy moat of the old city of Kandahar where Swinhoe says it arrived in enormous numbers in February. Meinertzhagen saw several hanging up for sale in Kabul on 13 April.

***Grus leucogeranus* Pallas.**

Blyth (apud Hutton, p. 791) states that the Great White Crane was procured at Kabul by Sir Alexander Barnes.

***Grus grus* (Linnaeus).**

Specimen collected.—sex? 7 Feb. 1903 Khwaji Ali (Cumming).

***Anthropoides virgo* (Linnaeus).**

There is no doubt that most of the cranes which visit the Punjab on winter must pass over Afghanistan on passage, but there are very few actual records of the fact.

For the spring passage Whitehead remarks that 'Residents at Parachinar say that Cranes on migration fly straight over the Safed Kob Range (lowest point 11,760 ft.) and not round the western shoulder, but that they are frequently forced to turn back by storms. Major Magrath, too, has often observed them returning south-east to Bannu after a storm'.

Cumming mentions the above specimen which was shot by Col. A. H. McMahon on the banks of the Helmund on 7 Feb. 1903 and says that he himself saw a flight passing over the Mission Camp at Kuhak on 30 March 1905.

At Kabul Meinertzhagen was informed that cranes pass north in large numbers in spring during the first half of April.

For the autumn we have the authority of Yate (p. 56). At camp Khusan in October 1885 he noted that large flocks were seen daily wending their way south doubtless on the road to India.

These records appear under the names of one or other of the two species, the Common Crane and the Demoiselle, but I have combined them because in my experience the identifications of cranes in the field are usually quite unreliable (though they are not difficult to separate by those who know the distinguishing points). The single specimen collected at Khwaji Ali has in fact appeared in print in different papers under both names in turn. Both species do however migrate through Afghanistan as Meinertzhagen saw a Demoiselle hanging in a poulterer's shop in Kabul on 13 April and Barnes figured a specimen from Kabul as the 'Shuk Duruck'.

***Ois tarda dybowskii* Taczanowski.**

Specimens collected.—♂ 29 Jan. 1885 Bala-Morghab (Aitcheson); sex? Jan. 1935 Danaghori 2,000 ft. (Maconachie).

Aitchison's specimen of the Great Bustard was shot by Lieut. Rawling out of a flock of seven. Weight 17 lbs.; weight of solid vegetable matter in the gizzard 2 lbs.; spread 7 ft. 4 in. This flock had been seen for fully a month in the vicinity and one had apparently been killed by a wild animal as feathers

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were picked up in large quantities. The bird was shot when the flock had been seen to alight on the top of a small hill with extremely precipitous sides, up which the sportsmen climbed. The stench of the bird was so great that the carcase was nearly abandoned by Mr. Rawlins.

Meinertzhagen ascertained that the Great Bustard is a regular winter visitor to the Danaghori Plains but it had just gone by the first week in May. Macnachie's specimen confirms this locality.

*Tetrax tetrax orientalis* Hartert.

Specimens collected.—sex? Koolsei near Khujah (Griffith); ♀ Nov. 1880 Kandahar (Swinhoe); sex? 12 March Maruchak, Murghab, sex? Dec. Chaman-i-Bed, Badghis (Yate).

The Little Bustard would seem to be a winter visitor to Kandahar. The above records are supplemented by St. John who says that he saw several specimens shot by sportsmen at Kandahar and once put up one himself when riding across country 12 miles south of that city in April.

*Chlamydotis undulata macqueeni* (Gray).

Specimens collected.—♀ 12 Feb. 1881 Abdul Rahman (Swinhoe); sex? Shorawak (Maynard); ♀ 25 March 1934 Logur 5,700 ft. (Maconachie).

The Houbara Bustard is fairly plentiful in Seistan during the spring according to Cumming, being found on the *dasht* salt-covered plains and sand-hills near cultivation. Four birds were trapped by Seistanis near Ziarat-i-Bibi Dost between Zahidan and Nasratābad and brought into camp at Kuhak on 18 March 1905. Several were subsequently seen about Sabzkim, Zaridan and elsewhere. The Biluch Nomads said that the birds bred locally but Cumming was unable to establish this point. Eastwards round Kandahar St. John said it was common on the edge of the desert but did not breed there. Swinhoe mentions a specimen shot at Maiwand by Capt. Cuthill in February. Maconachie's bird was presumably on passage.

*Burhinus oedicnemus* (Linnaeus).

Specimen collected.—sex? 11 March 1885 Gulran (Aitchison).

Whitehead states (on the authority of Mr. Donald) that the Stone-Plover occurs commonly on the boundary of Afghanistan in the desert country between Jamrud and the Khyber Pass. The above specimen supplies my only record actually within the country. It is in the British Museum (wing 237 mm., tail 117 mm.) and is labelled as *astutus* but it appears to me in colour to be very close to the typical race.

*Esacus recurvirostris* (Cuvier).

Cumming states that c/2 slightly incubated eggs of the Great Stone-Plover were found by some camel men at Kuhak not far from the Rud-i-Seistan and brought to him on 5 June 1904. As this would be an extension of range for this species and the measurements given ( $2.06 \times 1.5$  in.) would pass for extremes of either this species or the last, the inclusion of the Great Stone-Plover in the Afghan list needs confirmation.

*Cursorius cursor cursor* (Latham).

Specimens collected.—♀ 19 March Gulran, ♂ 8 June 1885 Karez, Khorasan (Aitchison); ♂ 13 March 1896 Lajjikarez 2,400 ft. (Maynard); sex? March 1903 Nadali, Helmund, 2 sex? April 1903 Khwaja Ahmed (Cumming).

Aitchison says that the Cream-coloured Courser was very common but very wary on the great gravel plains of the north-west and Cumming says that it is found all along the Helmund and its numerous branches. He adds that he had seen them in April so doubtless they breed there.

*Glareola pratincola pratincola* (Linnaeus).

Specimen collected.—♀ 23 April 1879 Kandahar (St. John).

This specimen, now in the British Museum, provides the only record of the Common Pratincole in Afghanistan.

*Glareola lactea* Temminck.

Two specimens from Jelalabad taken in March 1840 are listed in the Worcester MS. list in the British Museum.

*Larus ichthyaetus* Pallas.

Specimens collected.—sex? 14 April 1874 Panjah, Wakhan (Biddulph); sex? March 1904 Seistan (Annandale).

According to Cumming the Great Black-headed Gull is fairly common in Seistan. A live bird was captured on 2 April 1904.

*Larus ridibundus ridibundus* Linnaeus.

Specimens collected.—♂ 30 Dec. 1880 Kandahar, 2 ♂ 13 Feb. Argandab River, ♂ 24 Feb., ♂ 26 Feb.; ♀ 11 March, ♀ 17 March 1881 Kandahar (Swinhoe); ♀ 12 March 1885 Gulran (Aitchison); sex? 18 March Maruchak, Morghab (Yate); sex? Jan. 1904 Seistan (Cumming); sex? 11 Dec. 1918 Lab-i-Baring (Annandale).

The Black-headed Gull is a common winter visitor to Kandahar according to St. John and Swinhoe, and the latter says that they started arriving about Christmas, remaining on the marsh in large packs. The above specimens complete our information about the species.

*Larus genei* Brème.

Specimens collected.—2 ♀ 26 April 1905 Kuhak (Cumming).

Cumming shot the above specimens of the Slender-billed Gull at Kuhak from a small flock which flew overhead.

Blyth (apud Hutton, p. 792) mentions a gull which is figured in Burnes' drawings (of which the originals are in the Indian Museum, Calcutta) as 'shot at Cabul in the middle of February: a bird of passage'. He gives a very good description which in my opinion clearly refers to this species.

*Larus* sp.?

Large gulls of the *argentatus-fuscus* group occur in Afghanistan and there are the following records which I am not able to identify more exactly:—

(a) *Larus fuscus*. The adult and young are figured by Burnes from Kabul (Hutton, p. 792).

(b) A bird in juvenile plumage in the British Museum labelled 1 Nov. 1879 Kandahar (St. John) was called *Larus affinis* by Howard Saunders.

(c) A specimen, unsexed, from Landi Barech, Feb. 1903, was called *Larus argentatus cachimans* by Annandale.

*Chlidonias hybrida indica* (Stephens).

Specimens collected, sex? 29 May 1840 (Griffith); 2 ♂ 31 May 1937 Kabul 5,800 ft. (Meinertzhagen).

Meinertzhagen found hundreds of whiskered-terns on a shallow area of flooded land near Kabul on 31 May.

*Hydroprogne caspia caspia* (Pallas).

Specimen collected.—♀ 26 April 1905 Kuhak (Cumming).

The above specimen was one of a pair. Cumming says that the Caspian Tern was common in Seistan but he does not mention its status.

*Gelochelidon nilotica nilotica* (Gmelin).

Specimens collected.—sex? Jelalabad (Griffith); sex? R. Oxus, sex? 12 June 1886 Kham-i-ab, R. Oxus (Yate).

Cumming says that the Gull-billed Tern was common in Seistan and that some pairs were flying about on 22 April. Status uncertain. This and the Little Tern are evidently the species of Tern referred to by Yate (p. 245) as hovering over the pools of water caused by the overflow from the canals.

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*[Sterna melanogaster* Temminck.

Cumming says that only a few Black-bellied Terns were seen in Seistan and that it was less common than in India. As no specimens were collected I feel inclined to suggest that the birds seen were in reality Whiskered-term.]

*Sterna hirundo hirundo* Linnaeus.

Specimens collected.—♀ 28 April 1905 Seistan (Cumming); ♀ 10 May 1937 Danaghorī (Meinertzhagen).

Cumming says that the Common Tern was common in Seistan. Meinertzhagen found a few feeding on the open waters on the Danaghorī Plains in the second week in May.

*Sterna albitrons* Vroeg.

Specimens collected.—sex? 12 June 1886 Kham-i-ab, R. Oxus (Yate); ♀ 5 May Khwaja Ahmed, ♂ 6 May, ♂ 7 May 1905 Nasratabad (Cumming).

The above specimens supply the only records of the Little Tern except that Cumming, who says that it is common in Seistan, found pairs flying about on 5 May 1905.

*[Leucopoliis alexandrinus alexandrinus* (Linnaeus).

Specimens collected.—♂ 9 February, ♂ 27 February 1881 Kandahar (Swinhoe). Swinhoe and St. John say that the Kentish-plover is common in winter in the Kandahar area.

*Haematopus ostralegus* Linnaeus.

Blyth (apud Hutton p. 789) says of the Oyster-catcher 'Tertah-wuck of Cabul. Also procured by Sir A. Burnes' but I can find no further information about it.]

*Charadrius dubius curonicus* Gmelin.

Specimens collected.—2 sex? Kandahar (Griffith); ♂ 23 April 1879 Kandahar (St. John); ♀ 27 Feb. 1881 Kandahar (Swinhoe); ♀ 20 April 1885 Tirphul, Hari-Rud (Aitchison); 2 sex? 10 April Karawal Khana, Murghab (Yate); ♂ ♀ 11 March 1896 Lijjikarez 2,400 ft. (Maynard); ♂ 1 April 1904, ♀ 9 May 1905 Kuhak (Cumming); ♀ 16 April 1933, ♀ 2 May 1934 Kabui 5,700 ft., ♂ 21 June 1934 Logar 5,700 ft. (Maconachie); 3 ♂ 2 ♀ 6-7 April 1937 Kabul (Meinertzhagen).

The Little Rigid-plover is rather plentiful along the banks of rivers and streams in Seistan according to Cumming and as he saw some there in summer he considered that it most probably bred in the country.

In the Kandahar area it is common in winter according to both St. John and Swinhoe, the former adding that it stays until April.

In Northern Afghanistan, Meinertzhagen considered it to be only a bird of passage. He found it not uncommon in large wisps round water near Kabul in early April and many were seen in a poulterer's shop. A pair on passage on top of the Shibar Pass at 9,000 ft. on 18 April. At Bamian on 19 April a flock of eight arrived in the morning and remained throughout that day. Burnes procured it at Kabul.

It will be noticed however that Maconachie obtained a male at Kabul on 21 June and it seems difficult to believe that the bird does not breed more widely in Afghanistan than these records suggest.

I have combined all these records under the race *curonicus* as some of the specimens undoubtedly belong to it and it is the most likely form to occur. Annandale however records Cumming's birds from Kuhak as *jerdoni* and Maconachie's Logar bird (wing 109.5 mm) would certainly pass as that form.

*Cirripidesmus mongolus atrifrons* Wagler.

Specimen collected.—♀ 13 March 1896 Lijjikarez 2,400 ft. (Maynard).

This affords the only record of the Lesser Sand-Plover, which must be a passage migrant.

***Cirrepidesmus leschenaultii* Lesson.**

Specimen collected.—♂ 1896 Shorawak (Maynard).

The Large Sand-Plover must also be a passage migrant but this is the only record.

***Pluvialis dominica fulva* (Gmelin).**

Specimen collected.—sex? Afghanistan (Griffith).

St. John says that he shot a Golden Plover near Khalat-Ghilzai in October 1879 which he was unable to preserve but which he took to belong to the eastern form as the axillaries were not white.

Golden Plovers of sorts were seen by the officers of the Seistan Mission.

***Vanellus vanellus* (Linnaeus).**

Specimens collected.—♂ ♀ 24 Nov., ♂ ♀ 26 Dec. 1880, ♂ 11 Feb. 1881 Kandahar (Swinhoe); ♂ 16 Nov. 1884 between Zind-i-jan and Roznak, ♀ 16 Jan. 1885 Bola-Morghab (Aitchison); sex? 11 Feb. Chahor Sramba, Maimanah (Scully); ♀ 29 Oct. 1933 ♂ 28 Feb. 1934 Bagrami 5,700 ft. (Maconachie).

The Lapwing is evidently only a winter visitor to Afghanistan. It is common in the Kandahar area according to St. John and Swinhoe and Cumming says it occurs in Seistan. Hutton lists it for Kabul. The only other details are afforded by the above records.

***Chettusia gregaria* (Pallas).**

Specimen collected.—sex? Afghanistan (Griffith); ♀ 20 Oct. 1934. Kalayal (Maconachie).

The only records of the Sociable Lapwing.

***Chettusia leucura* (Lichtenstein).**

Specimens collected.—3 sex? Otipore (Griffith); ♂ 19 Dec. 1880, ♀ 15 March, ♂ 28 March, ♀ 31 March 1881 Kandahar (Swinhoe); 2 sex? 12 June Kham-i-ab, R. Oxus (Yate), ♀ Robat (Maynard); ♀ March 1903 Nadali, Helmund, ♀ 23 March 1903 Shahgul on Rud-i-Pariun (Annandale); ♂ 6 May 1905 Nasratabad (Cumming).

According to St. John and Swinhoe the White-tailed Lapwing is very common all the winter about Kandahar, but Cumming's specimen was the only one met in the Seistan area. Burnes procured it at Kabul. The only other information is supplied by the above records.

***Lobivanellus indicus algeri* Laubmann.**

Specimens collected.—♀ 21 Feb., ♂ ♀ 25 Feb., ♂ 15 March 1881 Kandahar (Swinhoe); ♂ 14 March 1896 Duganan 3,500 ft. (Maynard).

According to St. John and Swinhoe the Red-wattled Lapwing is common everywhere in the Kandahar area.

***Himantopus himantopus himantopus* (Linnaeus).**

Specimens collected.—♂ 27 March, ♂ 5 April 1881 Kandahar (Swinhoe); sex? R. Oxus, sex? 12 June Kham-i-ab (Yate); ♀ 11 March 1896 Lijjikarez 2,400 ft. (Maynard); ♂ 3 March, ♀ 3 Sept. 1904 Kuhak, ♀ 24 April 1905 Khwaja Ahmed (Cumming).

According to his Journal Griffith met with the Black-winged Stilt at Koonur (Kunar) on 31 March 1840 and at Chughar Serai-i-Pushat on 28 Nov. 1840.

Yate's specimen from Kham-i-ab on 12 June suggests that there may be breeding places in Northern Afghanistan and Cumming says that two birds were shot at Nasratabad by Mr. McManus on 13 May 1905.

In the main however the Stilt is evidently a passage migrant both in spring and autumn. Meinertzhagen saw several in a poulterer's shop at Kabul on 13 April. St. John says they were common in early winter and spring at Kandahar, his specimens being shot on 22 February and 9 April. Swinhoe says they arrived at Kandahar in some numbers in the middle of March. Cumming's specimens from Kuhak (3 March and 3 September) and Khwaja Ahmad (24 April) agree with this status while the two Nasratabad birds (13 May) may have been only late migrants.

***Recurvirostra avosetta* Linnaeus.**

Griffith mentions the Avocet in his Journal as seen at Pushut-Chughar Serai on 28 Nov. Otherwise it is only recorded by Meinertzhagen who saw some in a poulterer's shop at Kabul on 13 April.

***Numenius arquata* (Linnaeus).**

Specimen collected.—sex? Afghanistan (Griffith).

Blyth lists the Curlew from Kabul (apud Hutton p. 790.). Cumming says it is very common along the shores of the Hamuns of Seistan in winter.

***Limosa limosa* (Linnaeus).**

Specimens collected.—♀ 2 March 1881 Kandahar (Swinhoe); ♂ 6 May 1905 Nasratabad (Cumming); 2 ♂ 12 December 1918 Lab-i-Baring (Annandale).

Cumming's specimen of the Black-tailed Godwit, which was said to be largely in breeding plumage, was secured on 6 May by Mr. E. A. McManus from a flock of about 20 birds.

Annandale found this species feeding in large flocks at the edge of the Hamun in December. He watched them continuously grubbing in the mud where he himself could find no living thing. An examination of their stomach contents, however, shewed that they were feeding on the seeds of water plants which were doubtless lying dormant ready to sprout when the flood season began.

At Kandahar Swinhoe shot the above specimen out of a number which appeared to be on passage. There is evidently some mistake about Hutton's statement that this godwit is common all the year.

***Tringa ochropus* Linnaeus.**

Specimens collected.—sex? Pushut (Griffith); ♂ 30 Dec. 1880, ♀ 6 January, ♂ 1 February, ♂ 9 February 1881 Kandahar (Swinhoe); ♀ 9 Dec. 1884 between Ab-i-Kamarra and Ab-i-Shora, ♀ 1 April 1885 Gulram (Aitchison); sex? 14 April Karawal Khana, Murghab (Yate); ♀ Shorawak (Maynard); sex? 3 Sept. 1933 Sar-i-chashma 9,000' (Machonachie); 2 ♀ 13 April Ghorband 6,700 ft., 2 ♂ 18 April 1937 Ghorband 8,200 ft. (Meinertzhagen).

Apart from the above records Swinhoe and St. John found the Green Sandpiper common everywhere in the Kandahar area in winter. In the North Meinertzhagen met with it on passage. He says:—Common in the Ghorband Valley in flocks of from eight to fifteen birds in mid-April and were on passage being atrociously fat. At Bamian they were also in flocks, up to twenty birds, on 23 and 24 April. There were several single birds at Danaghori in the marshes on 7 and 8 May.

***Tringa stagnatilis* (Bechstein).**

The Marsh Sandpiper was noted only at Danaghori on 9 May, when a pair was seen, and at Haibak, when three were seen on flooded fields. (Meinertzhagen).

***Tringa hypoleucos* Linnaeus.**

Specimens collected.—sex? 18 May Darband-i-Kel Rekhta, Murghab, sex? 22 May Maruchak (Yate); ♀ 27 August 1933 Logar 5,700 ft. (Machonachie); 3 ♀ 14-18 April, ♀ 24 May 1937 Ghōrband (Meinertzhagen).

Both St. John and Swinhoe say that the Common Sandpiper is common in summer in the Kandahar area but no doubt they are referring to non-breeding birds as this species is not likely to be breeding in Southern Afghanistan. It might, however, breed in the Hariab Valley 7,000-8,000 ft. as Wardlaw Ramsay found a few pairs about the river there in May.

It certainly breeds in Northern Afghanistan. Meinertzhagen found that it had already arrived on the mountain streams by the first week in April and a pair was observed in copula in the Ghorbund Valley on 15 April. Observed also in breeding pairs on the river at Doab and Doshi in late April and early May. On the return journey they were noticed breeding in the Ghorbund and Paghman Valleys during the last week of May. Yate's specimens suggest that they breed in the north-west.

Meinertzhagen also observed passage movement for birds were found at Bamian in flocks of twenty individuals on 24 April in association with the Green Sandpiper and all had gone by the following morning.

***Tringa glareola* Linnaeus.**

Specimens collected.—♀ 1 May 1881 Gungazai (Swinhoe); ♀ 5 May Khawja Ahmed ♀ 7 May 1905 Nasratabad (Cumming); ♀ 6 August 1933 Bagrami 5,700 ft.; sex? 8 Sept. 1933 Maidan-i-Pai 9,100 ft., ♂ 6 May 1934 Chahar Asia 5,700 ft. (Maconachie).

The Wood Sandpiper was numerous in May in Seistan according to Cumming and the above specimens show that it passes through on both migrations. It is common according to St. John. Meinertzhagen saw three at Danaghori on 8 May in the marshes.

***Tringa totanus* (Linnaeus).**

Specimens collected.—♀ 9 January, ♀ 11 January, ♂ 24 January, ♂ 9 February, ♂ 30 March 1881 Kandahar (Swinhoe); sex? January, sex? n.d., sex? 7 January 1904 Seistan (Cumming); ♀ 20 May 1937 Khanabad 1,600 ft. (Meinertzhagen).

Swinhoe says that the Redshank is common throughout the winter on the banks of the Argendab River and St. John says that it stays till the middle of April. It also occurs in Seistan.

Meinertzhagen's specimen showed slight ovary development but he does not throw light on whether it appeared to be on its breeding ground.

Owing to the war I have not been able to examine the above specimens but Meinertzhagen calls his bird *terrignotae*.

***Glottis nebularia* (Günnerus).**

Specimens collected.—♂ 6 January, 2 ♀ 8 February 1881 Kandahar (Swinhoe); sex? 6 Sept. 1933 Farakhulm 9,300 ft. (Maconachie).

Both St. John and Swinhoe say that the Greenshank is fairly common in winter in the Kandahar area and Swinhoe says that it appeared to leave early in March.

***Philomachus pugnax* (Linnaeus).**

Specimens collected.—sex? Afghanistan (Griffith); 2 ♂ 4 March, ♂ 9 March, ♀ 11 March, ♀ 15 March, ♀ 22 March 1881 Kandahar (Swinhoe); sex? 14-23 April 1874 Panjah, Walthon (Biddulph); ♂ 19 February ♀ 4 April Chahar Shamba (Yate); sex? 1 March 1903 Shaharistan, Seistan (Annandale).

The Ruff and Reeve are common spring passage migrants in Afghanistan, passing through all parts of the country, mostly about the beginning of March. Earliest date 19 February. Meinertzhagen saw a few Reeves, but no Ruffs, in the marshes at Danaghori in 6 and 8 May.

***Erolia minuta minuta* (Leisler).**

Specimen collected.—♀ 5 April 1881 Kandahar (Swinhoe).

Both Swinhoe and St. John call the Little Stint a summer visitor to Kandahar but this is of course a mistake for spring passage migrant. Swinhoe says he saw several at Kandahar just before he left and he again saw it at Gungazi, Syed Yarroo and Kushdil Khan (in Baluchistan) in the beginning of May.

Hutton obtained it at Kandahar and Burnes at Kabul.

***Erolia temminckii* (Leisler).**

According to Blyth Temminck's Stint was obtained by Burnes at Kabul. Meinertzhagen saw a few singly and in pairs on the Danaghori marshes in the first week of May.

***Erolia alpina alpina* (Linnaeus).**

Specimens collected.—♀ 7 December, ♂ 8 December, 2 ♂ 13 Dec. 1918.

This affords the only record of the Lesser Sand-Plover which must be a Lab-i-Baring (Annandale).

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Annandale remarks that these 4 specimens of the Dunlin have wings 108-115 mm., so they must belong to the typical form. No other record.

*Scolopax rusticola* Linnaeus.

Specimens collected.—sex? 3 February Chahar Shamba, Maimanah (Yate); ♀ 26 Dec. 1931 Chailtan 5,900 ft. (Machonachie).

The Woodcock is a winter visitor to Kandahar—as Hutton, St. John and Swinhoe all record—first arriving about October or early in November and increasing with the cold weather about Christmas time and leaving about February or March. A favourite locality is the Arghundab River above Kandahar where extensive orchards and vineyards provide satisfactory cover. Swinhoe says the largest bag he had heard of was five in one day and Swinhoe mentions 20 killed in two days by two guns. Cumming says that one or two only were noted in Seistan. The only other records are provided by the above specimens.

*Capella solitaria* (Hodgson).

Specimens collected.—sex? Jugdulluck (Griffith); sex? 8 October Deh Tang, Ghorband (Yate); ♀ 26 Dec. 1931 Chohiltan 5,900 ft. (Maconachie); ♂ 9 April 1937 Paghman 8,000 ft. (Meinertzhagen).

There is no other information about the Solitary Snipe except Meinertzhagen's statement that his bird was one of a pair, doubtless in their winter quarters, on the rocky stream of the Paghman Valley amid snow and ice.

*Capella gallinago gallinago* (Linnaeus).

Specimens collected.—sex? Pushut (Griffith); ♂ 19 October 1884 between Hadj-Ali and Lundi, ♀ 17 January Bala-Morghab ♂ 19 March 1885 Gulran (Aitchison); sex? 5 February Chahar Shamba, Maimanah (Yate); ♂ 13 March 1896 Lijjikarez (Maynard); ♀ 10 May 1937 Danaghori 2,300 ft. (Meinertzhagen).

The Common or Fantail Snipe is evidently a winter visitor and passage migrant to the whole of Afghanistan from early in September until well into April. In Seistan, snipe settle in large wisps in the dense reed-beds of the Naizars according to Cumming. At Kandahar they swarmed in the large marsh outside the south gate, according to St. John, though better bags were to be made along the watercourses and in the inundated fields. The only idea of the numbers obtainable by sportsmen is given by Cumming who says that 18½ couple on 6 January 1905 was the largest bag for the Mission sportsman. Meinertzhagen says that fairly large bags are made round Kabul in March and April during passage. He noticed a few passing through Bamian on 26 April. On 7 May at Danaghori several wisps of a dozen birds or so were seen passing north at 6-30 p.m. and about a hundred feet up, calling loudly as they went and other birds from the marshes were seen to respond with a loud call and rise up to and join the migrating party.

At Danaghori there were one or two single birds in the marshes which may or may not have been going to breed. The female obtained showed slight ovary development.

*Capella stenura* (Bonaparte).

Cumming says that the Pintail Snipe is common in winter with the Fantail in Seistan, settling in big flocks in the dense reeds of the Naizars. There must be some mistake about this record, possibly confusion with the Great Snipe *Capella media*].

*Lymnocyrtes minima* (Brünnich).

Specimens collected.—2 sex? Pushut (Griffith); ♂ 19 Oct. 1884 between Hadj-Ali and Lundi, ♂ 5 March 1885 Gulran (Aitchison).

In North-west Afghanistan the Jack Snipe was seen occasionally all over the country according to Aitchison and it will be noticed that his specimens give arrival and departure dates of 19 Oct. and 5 March. Cumming says this species is moderately numerous in Seistan. At Kandahar St. John says that it arrives later and leaves earlier than the Fantail and Swinhoe says it came in with the very cold weather about Christmas, was fairly plentiful all through January and then disappeared again.

Meinertzhagen says there were many in the Kabul marshes on spring passage in the first week of April, as many as fifteen being shot in a day. In fact they then seemed to be more abundant than Fantails.

Griffith mentions in his Journal that the Jack Snipe was common at Bala Chughur Serai on 3 March 1840 and he notes it again at Pushut on 31 March 1840.

***Rostratula benghalensis benghalensis* (Linnaeus).**

Specimen collected.—sex? 17 April 1840 Jellalabad (Griffith).

Hutton says that the Painted Snipe occurs at Kandahar.

***Pelecanus onocrotalus* Linnaeus.**

Hutton describes a specimen of the White Pelican which he says was shot in a pool of water at Kandahar. It was alone and from its emaciated condition appeared to have alighted from fatigue. Several were brought into Kandahar, he continues, which had been found sitting on the rocks far from any water and had offered no resistance to capture. All these birds he considered stragglers from the large flocks that arrived on passage at the beginning of March, travelling eastwards.

Cumming also mentions a live specimen brought to Col. A. H. McMahon at Natal on 6 March 1903. This may have been the same bird as the unlabelled specimen which Annandale lists as a very typical example of this species.

As Yate (Northern Afghanistan, p. 56) remarks under Camp Kuhsan, Oct. 1885, that now and then a flock of Pelicans were seen travelling south, this bird would seem to pass over Afghanistan on both passages.

Cumming saw two large Pelicans (species unidentified) on the Hamun-i-Sabari on 12 January 1905.

***Phalacrocorax carbo sinensis* (Shaw & Nodder).**

Specimens collected.—♀ 14 March, ♀ 16 March 1881 Arghandab River (Swinhoe); sex? 19 March Maruchak, Badghis (Yate); sex? Feb. 1904 Seistan (Annandale).

Griffith describes in his Journal two cormorants 'distinct from any I have seen hitherto, very black with some white marks. The common black one also seen.' This was at Bala Chughur Serai on 16 March 1840.

St. John says the cormorant is occasionally seen on the Arghandab River but is not common. Swinhoe's two specimens were the only ones he saw.

In Seistan, cormorants are common. Annandale says they are captured and shot in large numbers by the Saiyids. The down from the breasts is sometimes mixed with the soft wool out of which the felt hats worn by Persians are made.

Scully says that the Maruchak specimen is in full breeding plumage.

***Phalacrocorax niger* (Vieillot).**

Specimens collected.—sex? 28 Dec. 1884, ♀ 12 Jan., ♀ Jan. 1885 Bala Morghab (Aitchison).

The only records of the Little Cormorant.

***Phalacrocorax pygmaeus* (Pallas).**

Specimen collected.—♀ 7 May 1937 Danaghori 2,300 ft. (Meinertzhagen).

Meinertzhagen says that the Pygmy Cormorant was not uncommon at Danaghori but he found no evidence of nesting though the large reed-beds were ideal for it.

***Platalea leucorodia* Linnaeus.**

Specimens collected.—2 sex? 25 March 1885 Kalla-i-Maur, Badghis (Aitchison); ♂ 4 June 1931 Bagram 4,900 ft. (Maconachie).

The Spoonbill was procured at Kabul by Sir A. Burnes. St. John says that he saw one at Khalat-i-Ghilzai and heard of others being shot. The specimens complete the records, but Maconachie's bird was received from captivity.

It should however be recalled that Magrath and Whitehead were standing on the Peiwar Kotal (8,200 ft.) on 30 April 1906 when a flock of about 20 Spoonbills came up from the Kurram and passed overhead—but apparently not

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relishing the strong north-west wind which met them as they topped the Kotal (i.e. pass) they wheeled round and flew back down the valley' (Ibis, 1889, p. 278).

***Plegadis falcinellus* (Linnaeus).**

Specimens collected.—sex? Pushut, sex? Afghanistan (Griffith); sex? 14-23 April 1874 Panjah, Wakhan (Biddulph).

From Griffith's Journal it is probable that his Pushut specimen was obtained on 31 March 1840. Sir A. Burnes met with the Glossy Ibis at Kabul and St. John says that a solitary bird is found here and there about the Kandahar area. Meinertzhagen saw a flock of twelve birds at Danaghori feeding in the marsh on 6 and 7 May. A second and larger flock was seen in a marsh near Kabul on 31 May.

***Caiconia ciconi* (Linnaeus).**

St. John says that the White Stork is occasionally noted at Kandahar on spring and autumn passage but curiously enough no one else has recorded it.

***Ciconia nigra* (Linnaeus).**

Meinertzhagen met with a single Black Stork in the stream-bed of the Bamian Valley on 27 April. It was very wild, rising at 500 yards and sitting on a rock so situated that he could see all around him. Blyth says that Burnes procured this species at Kabul.

***Ardea cinerea* Linnaeus.**

Specimens collected.—♂ 12 Dec., ♀ 17 Dec. 1880, ♂ 2 Jan., ♂ 26 Feb. 1881 (Swinhoe); sex? Feb. 1903 Khwaja Ali, sex? Dec. 1904 Farrah Rud (Cumming); ♂ 26 March 1933 Jebel Siraj 5,400 ft. (Maconachie).

The Heron is common in winter in the Kandahar area according to St. John and Swinhoe and Cumming found it in Seistan. Whether it breeds in the country is unknown. Sir Alexander Burnes obtained it at Kabul and Meinertzhagen saw specimens there for sale on 13 April. The latter saw several every day in the marshes at Danaghori in the second week in May and a single bird at Kunduz on 21 May.

***Egretta alba alba* (Linnaeus).**

Specimens collected.—♂ 24 Feb. 1881 Kandahar (Swinhoe); ♂ 11 June 1933 Kabul 5,700 ft. (Maconachie).

Meinertzhagen saw two specimens of the Large Egret near Kabul, namely a tired bird resting on ploughed land on 11 April and a second bird in a marsh on 31 May. The late date of Maconachie's bird should be noted. According to St. John and Swinhoe it is not uncommon about Kandahar, the latter considering it a winter visitor leaving about the end of March.

***Herodias garzetta* (Linnaeus).**

According to Blyth the Little Egret was obtained by Sir Alexander Burnes at Kabul but there is no other record.

***Nycticorax nycticorax nycticorax* (Linnaeus).**

Specimen collected.—♀ 1 May 1934 Jalalabad 1,800 ft. (Maconachie).

Meinertzhagen saw six Night Herons at Kunduz on 20 May flying over the marshes at dusk. In addition to Maconachie's specimen and St. John's statement that there was a small colony in a garden near Kandahar this bird is only recorded by Hutton as found in the winter on the banks of the larger rivers.

***Ixobrychus minuta minuta* (Linnaeus).**

Specimens collected.—sex? 28 April, sex? 1 May, sex? 15 June 1879 Kandahar (St. John); sex? April 1903 Khwaja Ali (Cumming); ♂ 27 May 1934 Bagrami 5,700 ft. (Maconachie).

These records are only supplemented by St. John's remark that the Little Bittern is not uncommon at Kandahar in summer.

***Bötaurus stellaris stellaris* (Linnaeus).**

Specimens collected.—♀ 18 March 1881 Kandahar (Swinhoe); 2 ♂ 1 ♀ 29 Dec. 1884 Bala Morghab, ♂ 15 Feb. 1885 Karawal Khana, Bedghis (Aitchison); sex? Dec. 1904 Farrah Rud (Cumming); ♂ 15 March 1933 Bagrami 5,700 ft. (Macconachie); ♂ 10 April 1937 Kabul (Meinertzhagen).

The Bittern appears to be very generally distributed in Afghanistan. At Kunduz on 20 May Meinertzhagen heard continuous booming in the marshes towards sunset and one is probably justified in believing that the birds were on their breeding ground. In the Morghab in winter Aitchison found it very common, living in exactly the same places as the pheasants. At Kabul according to Meinertzhagen it is a regular bird of passage and many are shot in the marshes there in spring. In the south Cumming's specimen shows that it is found in Seistan and Hutton says that it is found along the banks of the larger rivers such as the Arghandab and the Helmund. At Kandahar it seems to be a winter visitor but Swinhoe only met with it between the middle of February and the middle of March.

**[*Phoenicopterus ruber roseus* Pallas.**

Cumming states that he saw a flock of Flamingoes flying over the Mission Camp at Kuhak on 28 April 1905, travelling north in the direction of the Hamuns and odds that other flights were seen from time to time. The identification of the flocks with this species seems conjectural though no doubt both species of Flamingo occur in the country.]

***Phoeniconaias minor* Geoffroy.**

Specimen collected.—sex? June 1904 Kuhak (Cumming).

This specimen was identified by Mr. Stuart Baker who says that it is a young bird but exceptionally large with a wing of 13.6 in. (345 mm.). There seems, however, to be some confusion over the data as Cumming himself says that the only specimen secured by the Mission was shot by K. B. Mir Shams Shah on the Farrah Rud in Dec. 1904.

***Cygnus cygnus* (Linnaeus).**

Specimen collected.—[♂] Dec. 1904 Hamun-i-Sabari (Cumming).

Cumming says that 'a fine specimen of the Whooper Swan was brought into the Mission Camp on the Farrah Rud on 13 January 1905. It was shot by a Sayid (Fowler) on the Hamun-i-Sabari where it appears to be fairly numerous. Many of the young are said to have been caught on the Hamuns so that this Swan may be considered a resident.

This is evidently the same specimen mentioned by Stuart Baker (p. 132) and by Colonel Sir Henry McMahon (Ibis, 1906, p. 398) who says that it was obtained on 14 January 1905. I presume the contradiction in dates would have been due to the Sayid bringing in the bird as a skin and not in the flesh. Sir Henry goes on to state that the Mission observed a great many swans, all as far as he could see of the same species, and that he also saw several young birds which had been bred on the Hamun. This information was elicited by a note in the Ibis by Buturlin (Ibis, 1906, p. 737) suggesting on the authority of Sarudny that it was the Mute Swan (*Cygnus olor*) that bred in Seistan and that the Whooper was only a rare winter visitor to the country. Dr. Annandale (Ibis, 1906, p. 612) and Mr. A. Thomson (Ibis, 1907, p. 511) then wrote to confirm the identification of the specimen as a Whooper Swan.

Cumming was of opinion that the Mute Swan also occurred on the Hamuns of Seistan though no specimen had been procured.

***Anser anser* (Linnaeus).**

According to Cumming the Grey-Lag is common in Seistan. He preserved no specimens but says he obtained one near the Hamun-i-Sabari on 27 Dec. 1904 and was sent another from Kila-i-Nao during March 1905.

According to Hutton this species is a winter visitor to Kandahar. As Swinhoe, St. John and Murray all mention geese of sorts as being fairly common about Kandahar and the River Argandab, the probability is that they are, mostly referring to this species.

**[Anser albifrons (Scopoli).**

Murray says that a Mr. Hutchins obtained the White-fronted Goose on the Argandab River. Swinhoe says that he noted two (and he believed three) kinds of geese on that river in the winter.]

**Tadorna tadorna (Linnaeus).**

Specimens collected.—sex? Feb. Oxus River (Yate); pull. August, pull. n.d. Seistan, ♂ juv. Sept. Kuhak, 2 ♂ juv. 3 Oct. 1904 Seistan (Cumming); ♂ ad. 14 Dec. 1918 Lab-i-Baring (Annandale); ♀ 12 Nov. 1934 Kabul 5,700 ft. (Maconachie).

Cumming has the following note on the Sheldrake in Seistan:—'This is a permanent resident in Seistan and rather numerous during the winter. On 22 April 1904 the Irrigation Camp came across a large number of very young ducklings of this species between Chah Mahomed Raza and Sekkoha, in small bushes at the foot of the high "dash" on a dry portion of the Hamun. Near by were some low reeds, while the water of the Hamun itself was some three hundred yards off. There were several full grown sheldrakes, each followed by a brood of some 15 or 16 ducklings. Eleven of these ducklings were captured and sent to me and a few of them lived till they were full grown. On 24 June 1904 one of these flew away and I was compelled to clip the wings of the remainder.'

Hutton says the Sheldrake is a winter visitor to Kandahar as it may also be at Kabul and on the Oxus.

**Casarca ferruginea (Pallas).**

Specimens collected.—♀ 25 Feb., ♂ 1 March 1881 Kandahar (Swinhoe); sex? 10 April Karawal Khana, Murghab (Yate); ♂ 6 March 1886 Gulran (Aitchison).

According to Dr. Aitchison the Ruddy Sheldrake was occasionally seen and was breeding in the cliffs overhanging the Hari-Rud River.

Hutton, St. John and Swinhoe all agree that it is a winter visitor to Kandahar.

**Anas platyrhynchos platyrhynchos Linnaeus.**

Specimen collected.—♀ Shorawak (Maynard).

Meinertzhagen considers it probable that the Mallard breeds at Danaghori where a few were seen in pairs in suitable country on 6 May.

St. John says that he had seen 'a related couple or two' on the Argandab River as late as the first week in June.

With the exception of these two statements the Mallard is only known as a winter visitor or passage migrant to Afghanistan. At Kandahar Hutton, St. John and Swinhoe all found it common. St. John says it arrives about the end of October or early in November. Swinhoe found it common in January and February, starting to leave again at the beginning of March and all being gone by the middle of the month.

In Seistan Cumming says it is numerous on the Hamuns, arriving late in autumn and leaving in March.

Meinertzhagen found this to be the most abundant species of duck about Kabul both in the winter months and on spring passage.

**Eunetta falcata (Georgi).**

Specimen collected.—[♂] 28 Dec. 1884 Bala Morghab (Aitchison).

This specimen, shot by Capt. Heath, provides the only record of the Bronze-capped Teal for Afghanistan.

**Chaulelasmus streperus (Linnaeus).**

Specimens collected.—♂ 14 Feb., ♂ 18 Feb., ♀ 20 Feb., ♂ 20 March 1881 Kandahar (Swinhoe); ♂ ♀ 22 Jan.; ♂ 9 Feb. 1885 Bala Morghab (Aitchison); sex? 16 April Karawal Khana, Murghab (Yate).

The Gadwall is a winter visitor and passage migrant to Afghanistan and in addition to the above records from the north Burnes records it from Kabul and Meinertzhagen saw it hanging up for sale there on 13 April. In the

Kandahar area St. John says it was common throughout the winter and Swinhoe found it in great numbers throughout the months of January, February and March, leaving about the end of the last mentioned month.

In Seistan also Cumming says it leaves in March but there he did not find it common.

*Mareca penelope* (Linnaeus).

Specimens collected.—♀ Otipore (Griffith); ♂ 14 Jan., ♂♀ 20 Feb. 1881 Kandahar (Swinhoe); ♀ 14 Jan. 1884, ♂ 20 Jan. 1885 Bala-Morghab (Aitchison); ♂ 15 March Maruchak, Morghab (Yate); ♀ Shorawak (Maynard).

Swinhoe says that a few Wigeon are occasionally shot at Kandahar in January and February but that the species was scarce and he did not see it before or after those months. St. John also found it uncommon but Hutton calls it a winter visitor, disappearing gradually to the end of April.

In addition to the records for the north provided by the above specimens I may add that Meinertzhagen saw this species exposed for sale in Kabul on 13 April.

*Nettion crecca crecca* (Linnaeus).

Specimens collected.—♀ 14-23 April 1874 Panjah, Wakhan (Biddulph); 2 ♂ 17 Dec., ♀ 23 Dec., ♀ 25 Dec. 1880 Kandahar (Swinhoe); ♂ 23 Jan. 1885 Bala-Morghab (Aitchison); ♂ 25 Jan. Chahar Shamba, Maimanah (Yate); ♂ 1896 Sahibzada (Maynard); ♂ 3 Oct. 1904 Kuhak (Cumming); ♂ 8 Dec., ♂ 11 Dec. 1918 Lab-i-Baring (Annandale).

The Teal is said to be a very common winter visitor to the whole of Afghanistan wherever there is any suitable water, being found alike in the north, in Seistan and in the Kandahar area. It is also numerous on passage and Cumming relates how Capt. R. C. Bell saw thousands all over the country between Kuhak, Zahidan and Lutak between 1 and 10 April 1905. Every piece of water he came to was literally covered with them.

Whether the Teal breeds in the country is not quite clear. Swinhoe understood that it did so in the Kandahar area and says that he flushed 2 or 3 pairs at Syed Yaroo and Gangazai from the reeds in the watercourse at the beginning of May. Cumming says it appears to breed in Seistan and Meinertzhagen thought that it probably bred at Danaghori where he saw the birds in pairs in suitable country on 8 May.

*Dafila acuta* (Linnaeus).

Specimens collected.—♀ 18 Feb., ♂ 20 Feb. 1881 Kandahar (Swinhoe); ♂ 8 Dec. 1918 Lab-i-Baring (Annandale).

The Pintail appears to be one of the commoner ducks of Afghanistan as a winter visitor. Burnes and Meinertzhagen both record it from Kabul. St. John found large flocks in the inundated fields bordering the river near Kelat-i-Ghilzai in October. Hutton, St. John and Swinhoe say they are common at Kandahar in winter, Swinhoe adding that they left altogether about the middle of March.

In Seistan they are also common, arriving late in autumn and leaving in March according to Cumming.

*Querquedula querquedula* (Linnaeus).

Specimens collected.—♂ 14-23 April 1874 Panjah, Wakhan (Biddulph); ♂ 28 March 1881 Kandahar (Swinhoe).

The above specimens, doubtless birds on passage, furnish the only records of the Garganey for Afghanistan beyond the statement made by Blyth that Burnes obtained it at Kabul.

*Spatula clypeata* (Linnaeus).

Specimens collected.—sex? 14-23 April 1874 Panjah, Wakhan (Biddulph); ♂ 15 Feb., ♀ 27 Feb., ♂ 21 March 1881 Kandahar (Swinhoe); ♂ 18 March 1885 Kalla-Maur, Badghis (Aitchison); ♂ 1896 Shorawak (Maynard).

The Shoveller is said by Hutton, St. John and Swinhoe to be a common winter visitor to the Kandahar area which it leaves in March according to Swinhoe. Cumming found it numerous on the Hamuns of Seistan and suspected

that it might breed there. Burnes and Meinertzhagen record it from Kabul. Further north our only records are furnished by the above specimens.

*Marmaronetta angustirostris* (Menetries).

Specimens collected.—♀ 7 March 1881 Kandahar (Swinhoe); sex? 27 Oct. 1884 between De-Kamran and De-Doda; sex? n.d. Bala-Morghab (Aitchison); sex? 12 June Kham-i-ab, R. Oxus, Afghan Turkestan (Yate); 4 juvs. 6 July 1904, ♂ 22 April 1905 Kuhak (Cumming).

The headquarters of the Marbled-Duck in Afghanistan are evidently in Seistan and it is worthwhile quoting Cumming's account:—'Within a radius of 4 miles round Kuhak, Major T. W. Irvine, I.M.S., and Capt. R. C. Bed between 7 and 23 April 1904 shot no less than 80 of this species alone. It is a permanent resident and begins to breed at the end of April. I shot a pair on 22 April 1905 near Kuhak and found on examination that the female would have laid in about a week's time, while on 5 May of the same year a female with nest and 16 eggs, all more or less fresh, was sent to me by Lala Thakur-dass, Irrigation Supervisor, from near Old Shaharistan. Ducklings were also brought to me on the following dates:—

1 June 1904	...	...	...	1
14 June 1904	...	...	...	2
6 July 1904	...	...	...	5, nearly full-grown.
8 July 1904	...	...	...	Several, nearly full-grown.

I also shot a fully-grown bird on the Rud-i-Seistan on 3 October 1904.'

At Kandahar, according to St. John, the Marbled-Duck is not very uncommon, most large bags containing one or two, but Swinhoe says that his specimen was the only one obtained. The only other records are furnished by the specimens enumerated above.

*Netta rufina* (Pallas).

Specimens collected.—♂ 28 March 1881 Kandahar (Swinhoe); 2 ♂ Jan. ♀ 23 Jan. 1885 (Aitchison); ♀ Dec. 1904 Farrah Rud (Annandale).

According to St. John the Red-crested Pochard was not uncommon at Kandahar but Swinhoe says that he did not meet with it except in March when he knew of 5 being shot. Cumming found it numerous on the Hamuns of Seistan in winter and thought that it might remain to breed in the Naizar. Burnes recorded it from Kabul. The only other records are provided by the above specimens.

*Nyroca ferina* (Linnaeus).

Specimens collected.—♂ 9 March, ♀ 11 March 1881 Kandahar (Swinhoe); 2 ♂ 10 Dec. 1918 Lab-i-Baring (Annandale).

Burnes met with the Common Pochard at Kabul and Meinertzhagen noticed it exposed for sale there on 13 April. At Kandahar both St. John and Swinhoe found it uncommon, the former saying that it was not as frequently met as the Red-crested Pochard, the latter saying that a few were shot in March only.

In Seistan Cumming found it common in winter and he hazards his usual suggestion that it might breed on the Naizars.

*Nyroca rufa* (Linnaeus).

Specimens collected.—♂ 14 Feb., ♂ 17 Feb., ♂ 19 Feb. 1881 Kandahar (Swinhoe); ♂ ♀ 5 March Kila Wali, Murghab, ♂ 16 March Maruchak, Badghis (Yate).

Hutton, St. John and Swinhoe all agree that the White-eye is very common in the Kandahar area. Swinhoe indeed calls it the commonest duck in the country after the Gadwall and says that it arrived in the beginning of February and suggests that some appear to remain in the country to breed. He flushed many pairs out of reeds and tamarisk on the banks of the water-courses in the Pishin and right down the Bolan as far as Kirta in May (though these localities are of course actually across the Baluch border). Maynard met it on the Afghan-Baluch border.

Cumming found it common in Seistan in winter. Yate's specimens from the Morghab and Badghis complete the record.

**Nyroca fuligula** (Linnaeus).

Specimens collected.—♂ 19 Feb. 1881 Kandahar, 2 ♂ 1 ♀ 5 March 1881 Kokeran (Swinhoe); sex? 20 Feb. Chahar Shamba, Maimanah (Yate); ♂ Afghan-Biloch border (Maynard).

The Tufted-Duck is very common at Kandahar according to Swinhoe, arriving at the beginning of April. Cumming found it in winter in Seistan. Burnes found it common at Kabul where Meinertzhagen saw it exposed for sale on 13 April. Yate's Maimanah specimen completes the record.

**Glaucionetta clangula** (Linnaeus).

Specimens collected.—♂ 15 Jan. 1885 Bala-Morghab (Aitchison); ♀ 12 Feb. Chahar Shamba, Maimanah, sex? 15 March, ♂ 20 March Maruchak, Morghab (Yate); ♂ Dec. 1904 Hamun, Seistan (Annandale).

The above records suggest that the Golden-eye is a winter visitor to Afghanistan generally but in spite of Hutton's remark that it is common at Kandahar—neither Swinhoe nor St. John record it—it would seem to be uncommon. Cumming says that only two specimens were shot in Seistan by the members of his Mission. That was in January 1905 when the cold was unusually severe.

**Erismatura leucocephala** (Scopoli).

Specimens collected.—♂ ♀ 20 Oct. 1879 Jameh River near Khelat-i-Ghilzai; sex? 21 March Maruchak (Yate).

The Stiff-tailed Duck was first discovered in Afghanistan by St. John who procured the above pair of immature birds on 20 October 1879 on the Jameh River near Khelat-i-Ghilzai. The event is recorded in full by Hume in *Stray Feathers*, vol. viii, p. 456. Yate then obtained a specimen on 21 March at Maruchak and later Cumming found it very common on the Hamuns of Seistan during the winter when several were shot but apparently not preserved by members of the Mission.

**Mergellus albellus** (Linnaeus).

Specimens collected.—2 ♀ 30 Jan. 1881 Argendab River near Kokeran, ♀ 2 March 1881 Kandahar (Swinhoe); 2 ♂ 1 ♀ 29 Dec. 1884 Bala-Morghab (Aitchison); ♂ 10 Feb. Maimanah, ♂ 12 Feb., ♀ 17 Feb. Chahar Shamba, Maimanah (Yate).

The list of the above specimens is supplemented by Hutton's statement that he only saw one specimen of the Smew at Kandahar but heard that it was common in winter near Ghuzni.

**Mergus serrator** Linnaeus.

Specimens collected.—♀ 21 Jan. ♂ 30 Jan. 1885 Bala-Morghab (Aitchison). I can trace no other record of the Red-breasted Merganser in Afghanistan.

**Podiceps cristatus** (Linnaeus).

The Great Crested Grebe is only recorded by Cumming who says that it is fairly common in the Seistan Hamuns during winter. He adds that on 4 February 1904 he saw several near Puzak in the deep open patches of water.

**Podiceps ruficollis capensis** Salvadori.

Specimens collected.—♂ 4 March, 2 ♀ 8 March 1881 Kandahar (Swinhoe); ♀ 11 Dec. 1918 Lab-i-Baring (Annandale).

The Little Grebe is very common among the reed-beds of the Hamun in winter according to Annandale and it must breed there as a young bird was brought to Cumming at Kuhak on 7 July 1904. Hutton says it is common in the marshes and pools south of Kandahar in winter but St. John and Swinhoe both—probably more correctly—say that it is found there on passage in spring and autumn. Swinhoe says that it arrived in the beginning of March.

In conclusion it is perhaps worth stating that I can find no evidence for the inclusion of the following species or races in the avifauna of Afghanistan though that country is included in their range as given in the second edition of the *Fauna of British India, Birds*. That many of them do actually occur within Afghan boundaries is of course not improbable.

*Corvus splendens zugmayeri.*  
*Dendrocitta vagabunda*  
*Parus major intermedius.*  
*Parus palustris korejewi.*  
*Molpastes leucogenys leucogenys.*  
*Certhia himalayana taeniura.*  
*Oenanthe monacha.*  
*Phoenicurus frontalis.*  
*Rhyacornis fuliginosa.*  
*Calliope pectoralis pectoralis.*  
*Prunella himalayanus.*  
*Pericrocotus roseus.*  
*Phylloscopus tyleri.*  
*Phylloscopus pulcher kangrae.*  
*Seicercus xanthoschistos albosuperciliaris.*

*Scotocerca inquieta striata.*  
*Cephalopyrus flammiceps.*  
*Sturnus vulgaris humei.*  
*Uroloncha malabarica.*  
*Mycerobas melanocephalus.*  
*Hirundo rustica gutturalis.*  
*Anthus hodgsoni hodgsoni.*  
*Eremophila alpestris longirostris.*  
*Cinnyris asiatica brevirostris.*  
*Clamator jacobinus.*  
*Gyps himalayensis.*  
*Columba leuconota.*  
*Pterocles lichtensteinii.*  
*Lerwa lerwa.*

## SOME REMINISCENCES OF SPORT IN ASSAM.

BY

H. G. H. M.

(Continued from page 332 of volume 45).

### PART III.

In some parts of the plains of Assam are to be found vast stretches of country covered by grass in patches, in some places high and dense, in others light and interspersed with open spaces covered by green grass. These uncultivated areas are called 'chapris' and a well known one is the 'Pakar Chapri' which is surrounded by heavy, dense jungle bordered on three sides by a stream in which there used to be very good fishing. I use the past tense, for in Assam, as in most parts of India, the people of the country have woefully diminished the freshwater fish supply of the land by all sorts of poaching and destructive malpractices: and this is true of even the larger rivers.

To get to the Pakar Chapri from Sadiya one drives to the bank of the Brahmaputra river which is then crossed by means of a 'mar'. On the other side is a wide stretch of sand—this is in the cold season when the river runs low—over which is laid a brushwood track for the easier passage of motor cars. Thus one arrives at Saikwa Ghat, the terminus of the Assam-Bengal Railway. From here one motor's for miles and miles through heavy tree jungle, the haunt of all sorts of wild animals, and a rich avian life. Then one arrives at Kobo on the Brahmaputra which is reached by again crossing the river on a 'mar'. During this passage over the river there are sandbanks to be avoided and there are days when the crossing can be dangerous owing to a sudden rise in the river which at this place has not long issued from the mountains. Thinking of Kobo brings to mind the occasion when the Assistant Commandant at Pasighat was on his

way down to Saikwa Ghat. He ran his car down the bank too fast and so shot over the 'mar', burst through the pole barriers on the further side of it and plunged into the river! 'More haste less speed', 'Safely First' and that kind of thing. In the car was a box containing his wife's party frocks and fripperies. The box was to be forwarded to her in Shillong, and as the car was not retrieved from the water for several hours the state of the garments can be imagined, as also the state of mind of the poor wife when she saw them.

From Kobo we drove through more forest to Pasighat. This used to be a very pleasant place as the houses of the officials were along the river bank and one had only to go a hundred yards or so to fish for mahseer. There were times when there was not at Pasighat anyone fond of fishing. What waste of opportunity! On the way down river from Pasighat to Pakar Chapri there are many rapids to be negotiated, some of them, to the mind of a non-swimmer, appearing very dangerous, but good fun to those less timorous. I was in a large dug-out which could have easily been capsized, for the river had suddenly begun to rise and it was impossible to stop the boats which were, however, most skilfully managed by the expert and courageous boatmen. On the return journey I preferred to ride an elephant.

The elephants were made to swim across the river, and so swift was the water that they were many times submerged, only their trunks being above the surface, and how the mahouts managed to stick to their charges was a mystery to me, but all crossed in safety.

Life in this camp was very delightful. We had fishing and all sorts of shooting with rifle and shot gun. Daily the *chapri* was explored on elephant-back. A number of buffalo was seen, as many as sixteen in one herd, among them two young bulls; and one female had such enormous horns that we debated whether they were not something approaching the record which is nearly fourteen feet tip to tip across the forehead! I don't suppose they were within a couple of feet of that but it was seriously discussed whether we should shoot the animal and pay the fine of fifty rupees. Better counsels prevailed so she was left in peace. She was not an old animal, though to have attained such imposing horns she must have been well on in years.

Green-pigeon and jungle-fowl were shot, some of the latter with a .22 rifle as they pecked about on the edge of the cover across the stream. Green-Pigeon were in thousands in those parts, the larger flocks containing birds of several well-known species. Large bags are made during the months succeeding the breeding season, the time when this has ended being known by the birds collecting into huge flocks which, with some species, amount to many thousands. The largest bird is the Bengal Green-Pigeon; others are the Ashy-headed and the Thick-billed both of which are very fast fliers, and the Orange-breasted Green-Pigeon. The jungle fowl is the Common Red variety and among other game birds is the Black-breasted-Kalij Pheasant not easily come by owing to its skulking habits. That shoot at Pakar Chapri in company with our son-in-

law, C. of the Police, T. the Forest Officer, and N. of the Saw Mills (Bird & Co.) remains a very pleasant memory to us both. But I have forgotten the rogue elephant. There was known to be one in the jungles through which we had to pass on our way to camp: and my wife, who had not been on an elephant where tiger could be met since she experienced the charge previously related, was very much alarmed when the mahout suddenly pointed to a spot in the forest where an elephant had evidently just passed. I did not feel too happy, having with me only one of those all-in-one three-barrelled weapons—a double 12 gauge with a .405 barrel beneath. We pushed on as fast as possible and left the tree jungle for the open grass land as soon as could be managed. By doing this we saw various kinds of game animals: buffalo, sambar, hog-deer, also wild cats and pig. In the stream not far from camp quite large mahseer were caught.

On a number of occasions the Rajah of G. arranged shoots for the Governor of Assam and other high officials; then he would supplement his own elephants by animals of the Forest Department and others borrowed from zamindars. He did not very much care for these big occasions but always did his best to make them a success. From the time he arrived in camp he every evening interviewed 'khubberias'—bringers of information of the whereabouts of tigers, and decided what beats to carry out the next day. Buffaloes were never tied out as baits as is commonly the practice in other parts of India. Months before these important shoots his shikaris toured through all the likely jungle tracts and marked down all the places where cattle were being killed. A central spot was chosen for the camp—usually on the banks of a stream and in open country, so that those bringing information could have ready access to it. The men would cover all the country within ten or twelve miles round the camp. The informant was given ten rupees for each tiger shot, was fed in camp for as many days as was necessary, and taken out on a pad elephant when his particular tiger was to be hunted.

Every evening the Rajah arranged details of how the elephants should be fed, making fodder arrangements for twenty-four hours. He would also listen to all complaints, make particular enquiries as to any tusker becoming 'musth', and if in any doubt would personally inspect the animal. All elephants had to be daily examined for sore backs or other injuries, rope-galls and the like. In all this he was thorough and painstaking, as a good Commander should be, hence his known success on all occasions. A start was always made by 10 a.m. and the shooting ground reached by 1 or 2 p.m. Then, as soon as the Rajah had personally ascertained the lie of the land and the signs of the tiger being present were good, beats would be arranged, the guns placed in position, and the beat started, he himself giving orders as to the manner and direction of the drive. If tiger were few the sport was perhaps over by 3-30 p.m. when lunch would be served; but if there were several tigers then it was good-bye to lunch. On the way out and back all guests rode pad elephants, these animals having faster paces: they did not generally take part in the beats.

On return to camp tea was available, and dinner at 9-30 to 10 p.m. After that one could go to the big tent in which was singing and dancing. The first time I saw a boy dressed as a girl I was asked his sex, knowing the Rajah did not allow women in the camp I said 'Middle-sex'; and this was thought a great joke, that boy being ever after known by the name of Middlesex. The Rajah always said of these semi-official outings that they were not 'shoots' but huge picnic parties, and that it could be very dangerous both to guns and beaters. 'I like punctuality,' he said, 'and the starts are frequently delayed for one reason or another so the shooting ground is not reached in time and lunch is demanded, tables laid out, chairs placed, and so on, all meaning delay and waste of time, so that it is after 3 o'clock before a start can be made. Then the guns, having had lunch and beer are in an excited mood and do dangerous things; it is difficult to control, and frequently the tiger gets away from the beat.' One reason for tigers escaping without being shot at is that the mahouts, seeing the 'hullee' approaching and having little confidence in the howdah guns, deliberately cause their elephants to turn away and fidget, or even run away. The visiting sportsman as often as not knows nothing of 'hullee' sign, or that the elephant is being wilfully made unruly and does not connect this with the advancing tiger which quietly slips by and escapes the beat.

Mahouts have to be considered. Seated astride the necks of their majestic beasts they are in considerable danger from the attacking tiger, and it is natural they should be anxious as to the nerves and weapons of the sportsmen in the howdah, not only the guns on his own elephant but those on either side of him. They do not like single barrel weapons or small bore rifles, and one cannot convince them of the efficacy of magazine weapons. Very naturally mahouts discuss among themselves the merits and demerits of the various sportsmen, more especially on these semi-official shoots, and also gather information from camp servants as to their respective masters.

The Rajah always strongly objected to ladies shooting; he was ever afraid of something happening and there was once a terrible tragedy during one of his semi-official shoots. He never spoke of it. A mahout was killed, one of the guests shot in the ankle, and an elephant subsequently died of a bullet wound. To guests not known to him, not known that is as to nerves and straight shooting, he gave a card of 'Don'ts' and arranged for a reliable and experienced man to be at the back of the howdah. During beats he walked his own elephant backwards and forwards behind the line of howdah elephants and shot at those tigers only which were missed by the guests. I have seen him shoot a number of tigers under these circumstances.

The question whether tiger shooting from elephants is a dangerous sport is often discussed. Many there are who assert that it is not, but much can be said for the opposite view. Shooting tigers by sitting up over a kill at night is often looked down upon by those who bag tigers by beating for them. In the latter case the sportsman is almost always perched in a tree, on a ladder, or

other elevation as also in the former. In both instances the sportsman is in almost no danger unless and until he wounds the tiger.

Then, it must be admitted, he more or less takes his life in his hand when he follows up—as he must do; and, it has to be added, his mostly unarmed followers, without whose help he would, in most cases, be unable to locate and bring the wounded beast to action are equally exposed to death or injury.

Tigers are hunted and shot from elephant-back in jungles where to pursue them on foot is mostly impossible owing to the denseness of the cover. To beat them out without elephants is almost hopeless, the only alternative being sitting up, or through some more or less chance encounter.

Is tiger shooting from elephants dangerous? I think I can demonstrate from a number of experiences that, though it is not always so, it can be and may be; not so much on account of the attacks of wounded, surrounded, infuriated tigers as through the uncertainties and vagaries of elephantine tempers and irresponsible actions of people on their backs.

In the same year, the first of my tiger shooting career with elephants, there were, besides the charge of Sibjee against Jung Bahadur, two other instances of the kind. One took place at Bijni, the headquarter station of the Bijni Raj; the other at an estate owned by the zamindar of Rupsi. The Bijni Raj was then in the Court of Wards and the Manager had asked Mr. H. of the A.B. Railway and living at Haflong to a small tiger shoot. Both Mr. and Mrs. H. took part in the shoot and though tigers were seen none were shot owing to the small number of elephants available: one howdah and five beaters. Among the elephants was a notorious brute known to have killed some 15 mahouts and grass-cutters. During the beats he behaved himself, but when the party was returning he suddenly charged the elephant in front of him on which was seated Mrs. H. The animals were in single file and H., just behind, shouted to his wife to jump off and she was able to do this before the assault of the charging elephant arrived, falling between the oncoming beast and the one she had left with such presence of mind. I met her not long after at Dhubri and heard from her that she could not remember exactly what happened after leaving her elephant, only that she kept on rolling away. The attacking elephant knocked the other one heels over head, instantly killing the mahout. It was a miraculous escape for Mrs. H.

The other charge took place at a small tiger shoot on the Rupsi Estate when some twelve elephants were out. At the end of the day a male elephant charged sideways at a female, knocking it over. Of the three people aboard one was uninjured, the mahout was killed, and the other man had his jaw broken. Having some knowledge of dentistry I tried to improvise methods to keep the bones together but had to fall back upon the usual treatment which succeeded absolutely—a perfect result. This man could only remember that he found himself mixed up with elephant legs and then became unconscious. He probably received a kick from a fore-foot and was fortunate not to be more seriously injured.

The Zemindar of Rupsi, whom I knew well, met his death

through avoidable circumstances. The Zemindars of Lakipur got up a shoot to which Rupsi contributed his own nine elephants. With him was a Khasia boy he was supporting and educating. When the Zemindars learned that Rupsi intended to put this Khasia lad into howdah to use a rifle they objected, saying he had no experience and it would be unwise. Rupsi said he was certain the boy could use a rifle as well as any of them and that he would not be frightened if he saw a tiger. After these preliminaries the Zemindars decided to place the lad on the extreme right of the line of waiting guns as they did not expect the tiger to go there, and Rupsi was placed next to him. In Rupsi's howdah was sitting the 11 years old child of an English lady, the wife of one of the Zemindars. Things will happen, 'Kismet' one can call it. As soon as the line of beating elephants advanced the tiger was seen to be moving in the direction of the Khasia boy so Rupsi, an experienced sportsman, seeing this, moved down to the lad's elephant but was too late to steady the boy and give him confidence. The tiger was seen by the lad, who panicked, brought up his rifle in direction of Rupsi instead of the tiger, and pulled the trigger. Poor Rupsi was killed instantly, the high velocity bullet passing through his arm and on through the chest. In doing this it went very close to the small girl sitting next to him. A terrible experience, for she was drenched in his blood. We were on our way to a shoot with the Rajah of G when I met his Dewan who told me all this, at the same time informing me that three of G's elephants had gone *musth*, and in addition that a known bad elephant had escaped from the Zemindars' camp some forty miles away and was reported to be making towards G's camp.

Having heard all the news I drove on in my car and got into a bad bit of road where the car became ditched. Some villagers were yelling that the *musth* elephant was coming across the plain and I found the car could not be re-started. With me were .475 cartridges but the rifle had gone in advance to the camp; so we took suitable cover to see the elephant take no notice of the car and proceed on down the road. Were we relieved! This was a female called Megmala. Had I known that in time I might have been able to stop her and ride her to the camp.

The car was started without difficulty after it was found that my wife's handbag handle had slightly turned the switch key! When we got to R's camp we found there had been yet another tragedy. The Rajah of G had been out looking for tiger tracks and village 'Khubber' and somewhere about midday his mount Sibjee charged this female elephant Megmala from behind, knocking her heels over head and instantly killing the mahout. I saw the dead man; a good mahout whom I knew well. Megmala made her way across country to Gauripur, swimming the Brahmaputra on the way. For many years she was G's best howdah elephant but having been badly mauled by a wounded tiger could not, after that, be depended on.

That night I took my .475 (in case of accident!) and went to see the three *musth* animals picketted about a hundred yards from

the tents. Had one of these broken loose that dark night there would indeed have been trouble. The shoot was abandoned and being late in starting we did not catch the ferry, so returned to the Fakirganj Inspection Bungalow for the night. Our slumbers were not sound as Sibjee and the musth elephants were tethered in the compound! Glad indeed were we to return safely next day to Dhubri. Can tiger shooting off elephants be dangerous?

There will be more 'incidents' in course of these reminiscences, but at this point a method of shooting tigers off elephants which affords good sport and is not ordinarily dangerous may be suitably mentioned. The requirements are two reliable elephants, one for the sportsman, the other for two shikari attendants and to carry the bag to camp. A 'Charjamah' which is a pad having low rails is better than the more cumbrous howdah, which is not suitable for forest work. The method requires that the sportsman should be thoroughly acquainted with the habits of tigers; should know the language of the countryside; have a good manner in dealing with the people; and be not too niggardly, or the reverse, in payment for services rendered.

Where wild elephants are not uncommon all jungle animals are easily approached, and it is by quietly wandering along in the likely places, especially in the vicinity of any kill the whereabouts of which may be indicated by crows, birds of prey, or vultures, that tigers may be shot out of hand without incident, or may sometimes be moved out of cover by the pad elephant. Should the tiger be wounded there may be plenty of incident, but the sportsman is at any rate not in peril from actions of other elephants or sportsman. Silence on the sportsman's elephant is essential: any instructions to the other elephant being by whistle or signs, or signal horn when really necessary.

In course of Shikar of this description much jungle life may be observed—life of animals, birds, and insects which would otherwise never be seen, for it is a leisurely affair with plenty of opportunity for observation. It is not too much to say that a week of such hunting will furnish more experience of nature in the jungle than many 'shoots'. Elephants can be used with much success for fishing in deep and rapid streams where dug-outs or other boats are not easily obtained, carried, or used. From elephant back many places otherwise quite inaccessible owing to trees and riverside jungle growth can be well fished, and return to camp made without trouble. On such excursions a rifle or gun is usually taken in case of need as, apart from some chance opportunity of bagging a feline, the camp larder needs replenishing both for oneself and one's followers.

Howdahs in use over eighty years ago, as seen by illustrations in shikar books of those and earlier days, were of better design than many in use at the present time. There were, as there should be, places—racks—for several weapons on either side of the occupant of the front seat in the howdah. All sportsmen of experience say that more than one weapon is essential for howdah work, and one of these a shot gun. The Rajah of G always had 4

weapons with him and sometimes as many as six; but as many as that may be thought unnecessary.

A shot gun is advisable as, when a tiger is on the elephant, and perhaps trying to get into the howdah, a charge of shot is sufficient. On one occasion when shooting off Sibjee the Rajah was following a supposedly wounded tiger which was, however, unhurt. The tiger was a bad tempered beast and charged several times, being missed on each occasion owing to Sibjee dancing about. Eventually Sibjee turned and bolted or rather, as G said, the mahout it was who turned tail. The rampaging tiger followed apace—the whole shooting party seeing this wonderful show—caught up the elephant, jumped on from behind, and tried to get into the howdah. The Rajah had trouble with the occupant of the rear seat who lost his head and would not keep down, so the first essay with the shot gun was a miss. The noises of it caused the tiger to quit but he followed along and again got on to the elephant. By this time the back-seater was frantic and as G explained when it was all over, only by keeping the man's head down with his hand was it possible to use the gun. To use the weapon with one hand while the elephant was running as fast as it could was almost impossible; however, by pressing his knees against the howdah to steady himself as much as possible, he was at last able, as the tiger's ferocious head came over the howdah rail to place the muzzle against the beast's neck and press the trigger. So all was well.

This has been a long digression from the subject of howdah design but has an important bearing on it. I have seen a number of howdahs which are fitted with doors to admit of easy entry on either side. These doors sometimes fly open. Had that happened in the above encounter there would have been certain tragedy. In earlier days G's howdahs, and those I have seen on elephants of two Maharajah's had side doors, and were also too low front and back. A man sitting or standing in those howdahs was certainly not really safe as it would not take a great deal of movement on part of the elephant to toss him out. An instance was what happened to Captain R, then a Civil Surgeon. He was invited by the Rajah of G to a tiger shoot and while taking aim at an advancing tiger about twenty yards away his elephant suddenly lurched forward, causing him to hit against one of the doors which opened and shot him out somewhere near the tiger! G laughed at it afterwards, as R shinned up a small tree near by with the agility of a monkey; but it was no laughing matter at the time. After that occurrence G had all his howdahs altered to a fool-proof design.

Things may happen which put howdah construction to the most extreme test imaginable. Even when the elephant is tumbled on to its side it is possible for the sportsman to remain in the howdah, but only if it has high sides and no doors. This was the way of it.

The M brothers are two of the nicest men one could meet, both of them very good shots. They have seen hundreds of tigers

killed. On one occasion a large tiger pressed home his attack, landing on the head of the elephant on whose back was M senior. The elephant sank on one knee, which is their habit in an endeavour to kneel on the tiger and crush it. The tiger jumped on to the ground and with its forearms round the head, before the elephant could stand up, pulled it over on to its side. M's rifles and ammunition fell out of the howdah and it was with difficulty he remained inside, but he managed to do so by holding on to the rails. Three times the tiger pulled the elephant over. M still in the howdah, when finally, for no reason that could be imagined it suddenly abandoned the fight and was shot by other guns on nearby elephants. Things occur so rapidly in cases like this that it is impossible to see in detail what actually takes place. Only a cinema picture could show that, and changes in position take place so rapidly that it was not possible for guns on other elephants to risk shooting. In after years M was often asked what it felt like when the elephant went on its side with the tiger in touching distance. 'Yes', he would say, 'it was very touching, and I hope if it happens to you it will develop your sense of humour'. He himself had sense of humour particularly developed.

In a book 'My Sporting Memories', by Major General Wood-yatt, it is said, 'a tiger, though spined, struck a tusker elephant with its paw with such force that 2 claws were actually embedded in the elephant's thigh.' When told of the above the Rajah of G. remarked, 'Quite true. I have seen something similar. I once wounded a tiger at the end of a field, just short of the edge of heavy jungle. He was hit far back and the spine was broken. I pushed my elephant along and as I got close to him he was in a sort of sitting up position. I was preparing to kill the tiger when I saw to my left a number of tame buffaloes, among them an enraged bull pawing the ground and making ready to charge. Wishing to see what would happen I held my fire and to my surprise the bull actually charged the tiger which, in his crippled condition, waited until the bull put his head down. Then the tiger with a smack with one paw and a turn with the other knocked the buffalo over, killing him instantly. I could not believe the bull dead and waited for him to rise. Having killed the tiger we found the vertebrae of the neck had been dislocated'. I have read in shikar books of tigers, when breaking back through beaters, smashing a man's head like an egg-shell with a mere passing tap with a paw and can well imagine it happening: indeed, Mr Hazlitt, I.C.S., who was the Superintendent of the Lushai Hills, told me that he actually saw this happen. A tiger was seen to jump over the spot where an old woman was collecting firewood; when the party got to this place the woman was found dead with a fractured skull. As he jumped over he had just hit the head with his paw.

Most people having acquaintance with elephants know how much they dislike dogs, especially yapping ones of the small terrier variety but there are other animals equally obnoxious to them. In beats for tiger I have seen them show fright of even rats which

run squeaking out of the cover, and they have a marked dislike of wild pig, even giving the tiger sign—the metallic rap of the trunk on the ground with the accompanying low rumble, on their approach. At times they will even turn and run away from these small creatures, even rats!

One speaks of an elephant being perfectly steady but what is meant is that he will stand without movement, his mahout having given him the order by recognized pressure of knee or driving-hook, for the actual shot to be taken, a matter of a few seconds. While waiting for the beating elephants to approach he is constantly moving his ears and tail and shifting his weight from one leg to another, also swishing his legs with tufts of grass etc., to keep off flies: all this ceases for the taking of the shot; that is, it does when the animal is properly trained. A mahout will often be dozing during a beat but is wide awake when the time comes to be alert, and in any case a touch from the sportsman is sufficient warning. Just as a nervous rider will communicate his condition to his mount so will a mahout to his elephant. A good mahout will have a steady elephant as the sagacious beast soon knows he can trust him.

Bees and hornets may at any time be met with so a blanket is always carried. Blankets are also of use to quieten excitable animals, for even elephants becoming musth, if taken in time, can be controlled by a blanket over the eyes, thus averting possible serious consequences. Mahouts like the fun of tiger shooting and will deliberately leave camp on 'musth' elephants. It may be in case of beating elephants that they wish to enjoy the sport, for they all get an allowance whether staying in camp or not; and the drivers of howdah elephants are reluctant to forgo the chance of an extra ten rupees should the tiger be shot from their howdah. It behoves the organizer of the shoot to be always on the watch for an appearance of 'musth', and it is well for sportsmen also to be able to recognize the signs.

I have mentioned in connexion with the shooting of a rogue elephant that the right striker of my .475 H.V. rifle was found to be broken and that of course might have had serious or fatal consequences. Had I tested the rifle before setting out this would have been known. Such a thing should never occur, for it is so easy to make the necessary tests before putting the weapons away after cleaning. Dummy cartridges should always be used in hammerless weapons to guard against strikers being broken or damaged by snapping against no resistance. Before putting away hammerless and ejector weapons the springs should be eased; and it is seldom that the owners of ejectors know how this is done. Ejector springs cannot be expected to work for ever if put away at tension for months on end.

There is no doubt that a double barrelled rifle is better than a single for howdah shooting. The great advantage of the double is fully realized when a second shot has to be immediately taken. The few seconds longer needed to get off the single weapon may be all important; the bagging of the tiger or not. Shots at the head should be avoided. From elephant-back the plunging shot

between the shoulders is always fatal, that is if the bullet is what it should be. One of the secrets of successful tiger shooting, whether with elephant or with men, is never to hurry the animal, which ought to be brought to the waiting gun as unalarmed as possible so that a quiet unhurried shot may be taken, the angle being judged so that the bullet will find a vital place. Further dissertation as to shots to take and weapons to use or not to use must be held over to another time.

This rather rambling writing may be closed with some tales which occur to me as being perhaps of interest to the reader. Mr de C. was an Assam Police Officer who stood no nonsense, a man of action, if sometimes a little eccentric in some things. I can vouch for the following. He and a Sub-Inspector were in a hole in the ground waiting for the return of a tiger to his kill. The tiger was dragging the kill away in the darkness when de C got out of the pit, ran towards the kill and as soon as he was able to get his torchlight to bear killed the beast with a shot in the chest. This detail was given by the Inspector. On another occasion de C. was asked to witness the enclosure of a tiger in netting, a method practised in other parts of India also. He went with the Inspector of Police to see the fun. This was in the Dibrugarh District. He and the Inspector were standing very near the netting when the tiger suddenly charged and though it did not break through it tore the Inspector's coat and inflicted some scratches. This was too much for de C. He took an old D.B. 12 gauge shot gun from one of the villagers, put some shot cartridges in his coat pocket, loaded the gun with 'Lethal' bullets, raised the lower edge of the net and walked in. He had not gone far in the direction to which the tigress—for it was a female—had retreated when she charged at him belly flat to the ground, as he described it and as I have several times seen—no bounds or jumps. Before she reached him he shot her dead. Good work. He was making sure the tigress was dead when he was charged by a wild boar. He had just time to jump to one side and fire as the pig passed. The boar turned and again charged, but waiting until there could be no miss or ineffectual shot he killed the animal almost at the muzzle. Again good work. By this time the fore-end of the old weapon had dropped off and, without noticing this he reloaded with shot cartridges and leant the gun against the pig's body. How it happened he cannot say but both barrels went off and peppered some thirty coolies. Not such good work! Fortunately the distance was such that the pellets only penetrated skin deep. It was always a great joke: de C. bagging on one day a tigress, a boar and thirty coolies. But it was no joke at the time and the affair eventually cost de C. about a month's salary one way and another.

*(To be continued.)*

## CIRCUMVENTING THE MAHSEER AND OTHER SPORTING FISH IN INDIA AND BURMA.

BY

A. ST. J. MACDONALD.

(With 9 text-figures).

### PART IX

(Continued from page 321 of volume 45).

#### TANK ANGLING

The fish (1). Best places to fish (2). The Bottom (3). The Rod (4). Hooks (5). The Float (6). The Mount (7). Machan (8). Depth of water (9). Ground baiting (10). Method of Fishing (11). Bait (12). How fish bite (13). Striking a fish (14). Playing a fish (15). Shelving banks (16). Season and Time (17). Cutla fishing (18). Mr. Corbet's note on Cutla (19). Mr. Kitchen's note on Cutla (20).

#### TANK ANGLING FOR LABEO.

In this chapter I propose to deal briefly with bottom fishing in tanks for Labeo, Mirgil, and Cutla. For those wishing to further their knowledge I strongly recommend Thomas' TANK FISHING IN INDIA or better still HINTS TO AMATEURS IN TANK ANGLING, by P. N. Bhattacharyya, which cover the subject fully. Fishing for the predatory fish in tanks is dealt with in Chapter VII.

Although Mahseer rightly take pride of place with the angler in India, circumstances may not always permit or satisfy his wants. He may find himself stationed hundreds of miles from the nearest Mahseer water, with little opportunity of getting away. It is under these conditions that he has to turn to other fishing if one is still to enjoy the sound of a singing reel. The Rohu or Labeo and his two cousins run large and are strong fighters, and no mean game. Do not be discouraged by the Mahseer conquerer of fly fishers scorn, laughing down bottom fishing. If once tried to success you will be converted. These fish are to be found in tanks within easy distance of almost any decent sized town in the plains of India.

The method of fishing is a technique worthy of the best elements of angling, and on entirely new lines, to that of the float fisher in other countries.

Before settling down to the vigil of the float, standing upright, and only one inch out of the water, let us consider a few general principles, and why this is different to other forms of fishing.

*The Fish.*—The mouth of the Rohu (*Labeo*) is ridiculously small for his size but is well provided with taste buds, and situated well below the head. The same applies to the Mirgal, but to a slightly lesser degree. The Cutla has no taste buds, but a large mouth badly put on with no upper lip, thus causing the mouth to open upwards. This makes them all feed and take bait in a similar manner, i.e. by sucking in their food, much as a puppy does, when feeding from its mother. Their natural food appears to be slime and weed on or near the surface, and organic matter on the bottom; but paste and worms are readily taken, and provide an ideal bait.

It is to the peculiar nibble with which these fish take the bait, that tackle has to be adapted, in order to detect the slightest movement of the baited hook.

The float must be light and sensitive, a porcupine quill or the tail feather of the Peacock cut to a suitable length and bound with silk do excellently when adjusted correctly so as to register the minutest bite.

2. *The Best Places to Fish.*—Time spent in the selection of firstly the tank, and secondly the part of the tank, is well repaid.

Old tanks with weeds or masonry walls or steps, that are land bound with no water escape, will generally hold good fish. This is provided it is protected from netting and does not dry up in the hot months.

Having selected an old tank and satisfied yourself that it holds *Labeo*, the next point is to select a suitable place from which to fish, and erect a machan, if you can reserve a place for a fee.

Here are just some of the points to consider in the selection of a site.

(1) Avoid sitting with the sun in your eyes, and as far as possible select a part of the tank shielded from the wind.

(2) The bottom flat and firm, at a depth of from 4 to 6 feet.

(3) Should there be a *Ficus* tree overhanging the tank, select it to fish under. All fish are attracted by ripe figs or berries. Bathing ghats; where pots and pans are washed; near masonry walls or steps; at the entrance of water feeder channels,—are all good places to select.

3. *The Bottom.*—Survey the bottom with a plummet, and wherever possible select a flat portion, this is very important for the correct adjustment of the line and float. Most tanks are however basin-shaped with shelving sides, special adjustment to the float must be made in such cases. (See Fig. 8)

Having considered the fish and selected the tank and fishing site, we will now consider tackle.

4. *The Rod.*—Cheap ringal rods can be obtained in the bazaar of any decent size town, their price, mounted and fitted with rings, is only Rs. 4 or 5. Better rods can be had from any of the tackle makers. Ten feet or so is quite long enough, it must however be

fairly stiff for brisk striking, the same as a casting rod, on 'Wee Murdoch' lines.

Cheap brass reels can be had for Rs. 10 or so, and are good enough, with 100 yards of line.

Twisted or plaited lines can be had for Rs. 4 or Rs. 5 per 100 yards. The Tussa silk lines are the most favoured, as they are elastic and give with the strike which is necessary. They are cheap and very strong. Any good line does. I myself favour a smooth green or black line, not the khaki colour, and rough coil of the Tussa which must set up reactions in water.

5. *The Hooks*.—The short shank variety is the best for this form of fishing, and the types made in Calcutta and stocked by Mantons and called 'For India' are as good as any. I like Hardy's best. I give here a diagram of one I had specially made by them.

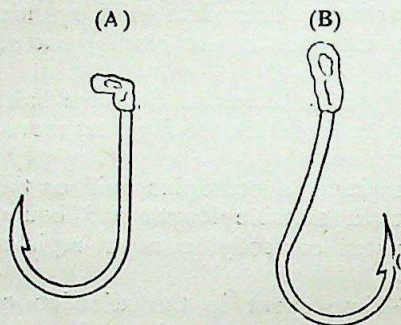


Fig. 1

(A). The advantage of A over B is the short barb to the point of the hook, for easy penetration. And the wide rounded sweep of the hook and turn down eye, for direct draw by the line.

The important thing is a short shank with a sharp point, and a thin short barb. [See Fig. 1 A].

6. *The Float*.—A quill float made up of either the tail feather quill of a peacock, or a thin porcupine quill. In the case of a feather quill, it is made up with fine cotton or silk lashings at intervals of  $\frac{1}{2}$  an inch, to enable one to detect the slightest movement of the float. It should be about  $4\frac{1}{2}$  to 5 inches long, with a loop at one end a couple of inches long. (See Fig. 2).



Fig. 2.—A quill float.

The float can be either attached or taken off quite easily, by bending the line double, passing it through the loop and over the end of the float. This gives one a slip knot over the line, so that the float can be run up or down the line to the required depth.

7. *The Mount*.—For very clear water, a good mount is a single hook mounted to a couple of lengths of stout gut, with a small lead, the weight of 2 or 3 B.B. shot. In coloured water, the ordinary mount with two hooks is good enough, mounted on to line. This then completes the outfit, the whole of which should be obtainable for Rs. 30. (See Figs. 3 and 4.)

8. *The Machan*.—These can be made from either bamboo or timber, though the latter is the better, and this I consider the most important factor to success. The machan must be *rigid*, as however expert one may be at sitting still, there are times when

movement is necessary and if the machan is not quite rigid on its supports, fish are frightened away; the lower the platform is to

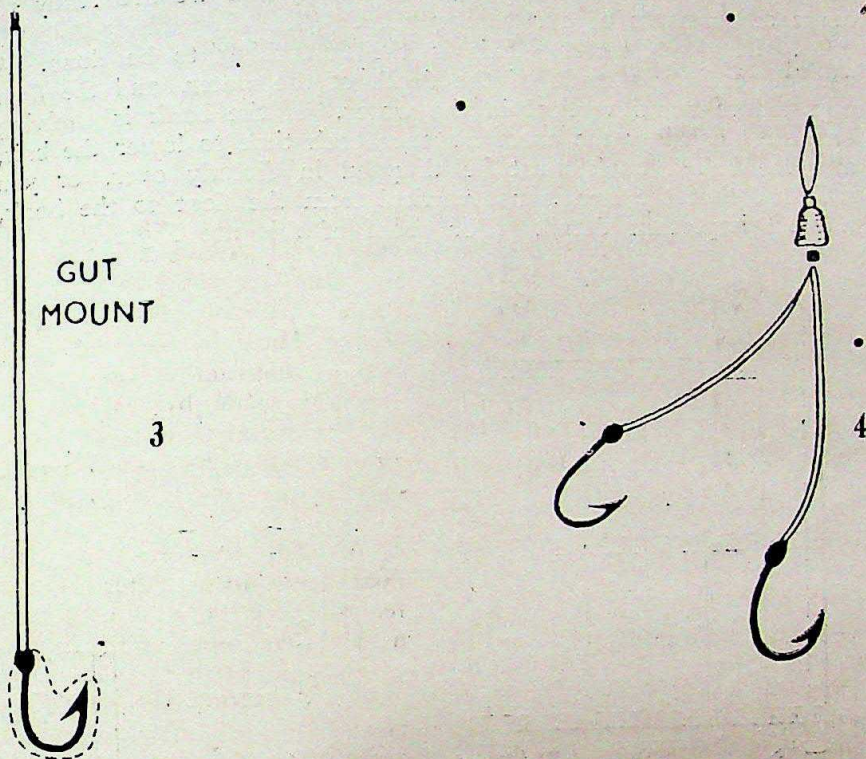


Fig. 3.—Gut mount shelving banks or clear tanks.

Fig. 4.—Two hooks for flat bottom fishing.

the surface of the water the better. A small footway connecting the machan to the bank, should not be attached to the machan, but a small gap left between, so that if an attendant brings any-

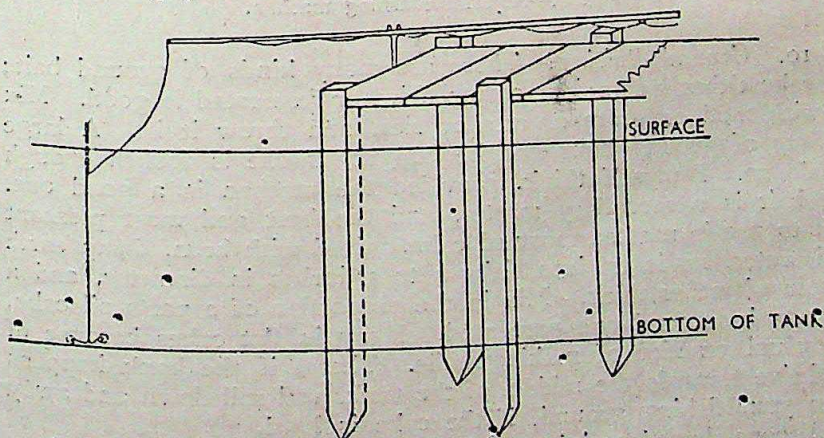


Fig. 5.—Machan showing rod rest, point of rod, float in correct position and directly over bait.

thing along to you, while you are fishing, his movements are not taken by the posts of the machan. A small stool or chair of any kind, and a rod rest completes the outfit, and we are ready to make adjustments of our fishing gear. (See diagrams 5 & 6.)

9. *Depth of water.*—This is the first thing to be done. A careful reading is made of the depth of the water, and the float adjusted to stand vertical in the water. If the bank is shelving one must consider the exact distance each time to lower the bait, and the baited hook must be dropped in directly over, or you will find that the line is not vertical from the float to the hook, a most important detail. (For proof of this see Figs. 5 & 8.)

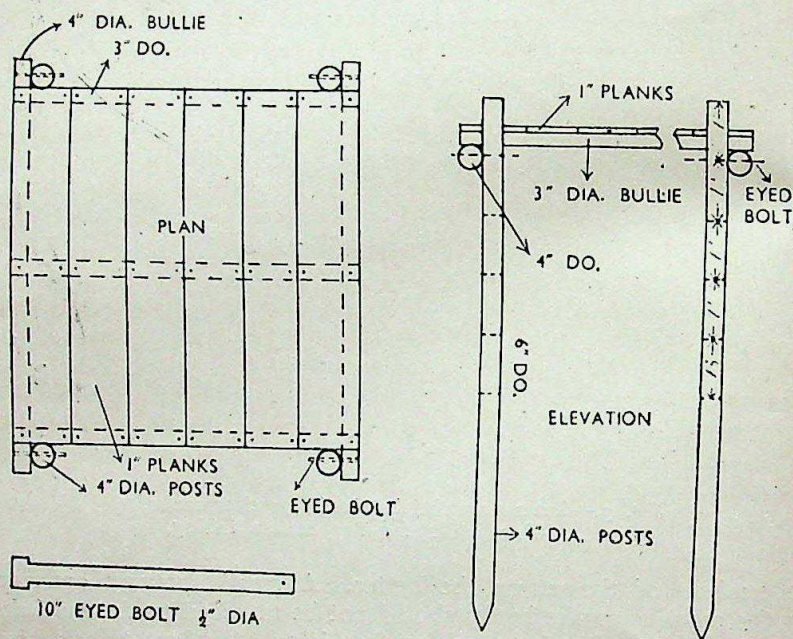


Fig. 6.—Adjustable fishing machan.

10. *Ground Baiting.*—There are many kinds of ground bait; oil cake either mustard or castor, fried or fermented is good. Mix it with mud or gram or atta or rice, and throw it in. A large variety of ground baits can be bought, if one is foolish enough to do so. I myself think, provided the machan is a good one, the bait is a secondary matter; and the best and most pleasant bait to use is roasted mustard cake, mixed with bran, damp earth and water, made up into slabs 4 to 5 inches in diameter, and a couple of inches thick. Mix in the proportion of 2 parts oil cake, 2 parts bran, and one part mud. I say in flat cakes because of the usual practice of making balls. These, if the bank happens to shelve towards the middle of the tank, will roll down and away from your fishing ground, if the cake is hard.

A cone-shaped weight, with a cork strip let in, and a loop at the top, is best, and the most convenient plummet, but any weight will do equally as well. A 'Hillman Lead' for instance,

11. *Method of Fishing.*—The points to attend to then are:—  
(1) Ground bait for 3 or 4 days before you attempt fishing, depending on the size of the tank.

(2) If the bottom is soft and muddy, a good dodge is to drop in a few baskets of gravel, and have it settled on the bottom by some local fishermen, Malars or any other of the tribe who can dive, this is a precaution well repaid, and is besides an attraction to the fish. Only 3 or 4 sq. feet of bottom need be prepared in this way, so that the baited hook will not be obscured from view, by sinking into the soft mud.

(3) Next get the correct depth in a vertical line from your float to the bottom, by means of the plummet. This should be adjusted, so that the float is  $\frac{2}{3}$  under and  $\frac{1}{3}$  out of the water, or as near as possible, with the sinker just resting on the bottom. (See Fig. 7.)

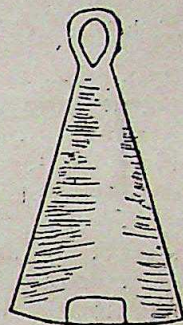


Fig. 7.—Plummet.

(4) The float should be as near and under the point of the rod as possible, with the head line reduced to the minimum. This enables one to instantly strike a fish. It will be seen later that this is of great importance. The weight of the baited hook should be greater than the resistance of the float. That is, if the line connecting the float to the bait is less than the depth of the water, the float should be carried under water. This is important.

12. *Bait.*—The usual bait is paste, either flour or atta, or nice red worms. There are many others besides. Adding smelly stuffs to the bait, onion juice, turmeric (huldee), asafoetida (heeng) and numerous others; dried weed powdered and mixed with gram flour is supposed to be good for *Cutla*. Whichever is selected, should be prepared in the manner I have suggested for mahseer fishing, by boiling it a few minutes, when it gets nice and sticky, and will not leave the hook so easily as if it were not so treated. Mixing cotton wool is another dodge, a bait little known is the leech. It is a lively worm and takes excellently, only give a fish lots of time before you strike.

White ants or wasps' eggs are sometimes fancied. The variety of bait used by the Bengali and the Mohammedan would fill a book; let us select from this humble list, one of the few mentioned.

13. *How Fish Bite.*—The idea of so sensitive a float, is to register the slightest nibble of the bait, these fish bite in a very delicate manner. The first indication of the fish at the bait, is that the float moves slowly, either up or down, this being followed by a number of bobs, moving perhaps half an inch in either direction, or even less. Strike when the float is going down, or when the fish is sucking in the bait. The other signs are, float slowly disappears or lies flat on the surface, both are indications to strike, and more satisfactory than the first mentioned. In the second case, the fish has lifted the bait into its mouth and is moving off. A third, is the fish lifting the bait off the bottom, and taking the weight of the sinker off the float by moving upwards. Strike hard.

14. *Striking a fish.*—The more pliable a rod the less chance of breaking your line in a strong strike, which must be sharp and firm, to send your hook home into the tough mouth of the fish, and it must be quick or the fish expels the bait from his mouth, as soon as he feels the drag on the line. Too stiff a rod will cause breakages, which occur in the most mystifying fashion. You strike but do not feel the fish, yet the line snaps. The best way, I think, is to strike off the reel, provided you have a strong check. Do not hold the line against the rod when striking; with sharp hooks a single-handed strike is quite sufficient to drive the hook home.

15. *Playing a fish.*—If possible move away from the machan, so as not to disturb the baited ground. A landing net or an attendant can then fix your fish for you. The Rohu goes off with a strong rush when hooked, and will sometimes jump out of the water. The Mirgil often comes to the surface on being hooked, and remains there a few seconds, before dashing off.

16. *Shelving banks.*—If the tank has a bottom falling away to increasing depth, I have found that the small weight can be dispensed with, and a very light and long float used, say 10 inches. Allow the bait to rest on the bottom, with the float as much out as possible, the object of the large float is obvious, and re-

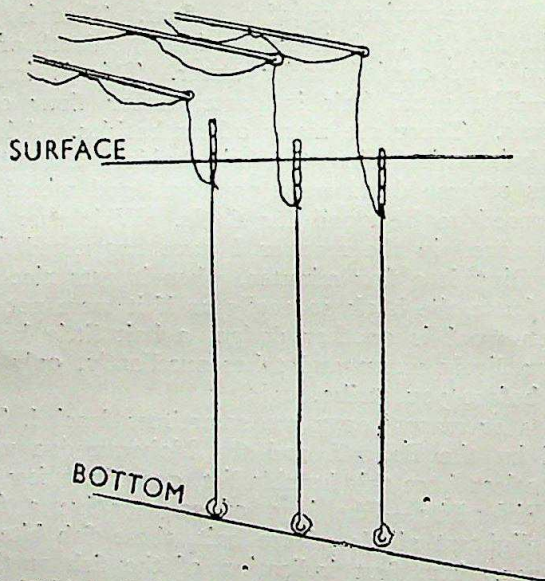


Fig. 8.—Position of float alters with position.

duces the error of exactness in lowering the bait. Frequent striking is necessary, under these conditions, or the bait gets carried down beyond the registering depth of the float. (See Fig. 8.)

17. *Season and time.*—This is a matter of local conditions. In so vast a country as India a general remark is all that is possible. The rains is the best time, when the fish take fairly regularly, almost all day; in the hot weather the morning and

evening at the changing of light, appears to be the best time, from 5 to 9 a.m. and then again from 4-30 to 7 p.m. or until it gets dark.

I hope that this brief description of the methods, aided by the diagrams, will acquaint the reader sufficiently with this form of fishing, and that it will help him to success. They are no mean game, either in circumventing or fight, and well worth an afternoon's sport, for they will steal your bait, and tax both skill and patience to the utmost.

### 18. CUTLA FISHING

The Cutla is to be found in most tanks where one gets Rohu and Mirgil and attains a greater size than either of the two fish just mentioned.

It is rarely caught hooked in the mouth; I have never caught one, though I have fished in tanks where they were plentiful, and attained a huge size.

The methods of foul hooking, used by Bengali gentlemen, who incidentally are masters at this form of fishing, are fully described by Mr. Bhattacharyya in his book, and in Mr. Kitchen's Note.

I am indebted to Mr. A. Corbet for the following Note on Cutla fishing, and can thoroughly recommend it to all tank anglers. Mr. A. Corbet has caught more large fish in tanks than any one else I know.

### 19. CUTLA FISHING BY A. CORBET

'Cutla buchanani. U. P. 'Boassa.'

Teleg., Botchee, Punj. Taila., Bom.; Tambrā: Behar, Bhakur., Hind., Bing., U.P. 'Boassa.'

'Usually found in all tanks throughout India. Represented by only one species.'

'Like a carp in appearance, but much more heavily built, and attaining a very large size, sometimes about 100 pounds. Very large head, the length of the fish is usually three times the circumference of the head, broad snubby snout, mouth turned upwards, with no upper lip.'

A bottom feeder, like most other tank fish, and not quite as shy. Often known to take bait within a yard of the bank, in three to six feet of water or deeper. Its nibble is shy and gentle.'

'A spot or "char" should first be selected in the tank, preferably where the water is from 3 to 7 ft. in depth, and the bottom for about 12 ft. out and 5 ft. across be thoroughly cleaned of all grass and weeds, also of all black or ponky, rotted earth, found in most tanks.'

'Liberal ground baiting is necessary, and there are several highly vaunted nostrums for this purpose. A few of the most successful used for attracting most kinds of Tank fish, are—fried mustered oil cake (khulli), teemul, methi, mumgreilla, and jeera.'

'A small portion (about 1 oz.) of each of the last four named ingredients should be fried and pounded, and mixed with reddish earth (Chikna Mufi), the fried mustard cake can either be crushed and added or thrown in whole pieces of about  $\frac{1}{2}$  pound in weight.'

'The mixture of earth and ingredients should be made up into small flat cakes, the size of the palm of the hand, and thrown into the fishing "Char".'

'The baited hook should rest on the bottom, where the ground bait has been laid.'

'Tank fishermen are always pestered by turtles, prawns, or crabs. A good method of keeping the first two away from a fishing "Char" is to fill a

bottle straw with any old raw meat or chicken entrails tying up both ends attach a stone and sink about 10 ft. away on any side of your "Char", this will keep them busy most of the day.

A handful of "Dhal" thrown around your bait, is useful in keeping away crabs.

*Bait.* Most kinds of paste bread, boiled flour and atta from preference. Before the monsoon when the water in tanks is low, and not too clean, some honey mixed with the paste bait, preferably flour, which is the whitest bait, is recommended. Cutla seem to be attracted by most highly scented baits, and during the Jack fruit season, a couple of dozen flakes thoroughly ripe, mixed in with the ground bait, is a most successful lure. Slight flavouring of the same fruit, used in the hook bait or paste, adds to its effectiveness. Besides paste bait, cutla and other tank fish will take wasp and bee grubs, maggots, sometimes worms and pieces of raw prawns.

*Tackle.* All that is required is a one-piece bamboo rod, fairly 'stiff, with some country silk tussore line, preferably mooga four ply, medium thickness. Special modern rohu hooks, easily obtained these days, and a peacock quill float about 6 inches in length'.

Mr. A. Corbet has not detailed the method of fishing, but this is the same as mentioned earlier in this chapter, for all bottom feeding fish.

I am also indebted to Mr. P. H. Kitchen for the following note on Tank Fishing. Mr. Kitchen is an experienced angler, and sent me besides some very interesting notes on Mahseer fishing in Burma.

His note on the Cutla is most enlightening and the ratio of Cutla to the Rohu and Mirgil he has taken, is better than I have had the good fortune to experience. I have caught scores of Rohu and Mirgil, several over 30 pounds, but never a Cutla, although I have fished in tanks where they were both numerous and large.

## 20. TANK FISHING BY P. H. KITCHEN

"With 18 years' experience of tank fishing between Calcutta and Hazaribagh I would unhesitatingly advise the angler who aspires to even moderate success in Bengal waters to study the methods of Bengali fishermen, and with but slight modifications to adopt his ways to theirs. With this word of caution I shall proceed to a general description of tackle required and the method of using it.

*Rod.*—A plain Ringall bamboo, length 10' to 11', never more, stiff in the butt, and with a medium pliable top is the best. When such sophisticated and shy fish as Cutla are nibbling, the strike must be as quick as lightning, and a flexible rod would spell failure.

The first reaction to a sharp strike with a pliable rod is that the point bends downwards and strikes the water and the fraction of a second is lost before the point springs back and tightens the line. This means the loss of the fish. When selecting a rod care should be taken to pick one in which the knots are close together, and of which the outer skin is bright and glossy. These are stronger and quicker, and do not warp so easily as bamboos of which the knots are far apart and of a dull appearance. Linseed, or mustard oil should be rubbed into the rod monthly, and if this is done, and granted a rod has been carefully selected in

the first instance, there is no reason why it should not last for 15 years.

Such a rod mounted by the angler with which fittings and rings would cost about Rs. 3. Tackle shops would charge Rs. 10 to Rs. 15.

*Reel.*— $3\frac{1}{2}$ " to 4" preferably of aluminium alloy. Revolving plate, plain check.

*Line.*—Cotton and flax lines are inclined to swell in water, and are not as good as undressed, handmade, silk Mooga lines the best quality of which costs Rs. 2-8 per tola. These lines are immensely strong in proportion to their thickness and are slightly elastic.

*Gut.*—Quite unnecessary. Japanese 'Ja-gut' is all that is required.

*Hooks.*—Short shank, round bend, needle pointed. Genuine Burdwan hooks are the best. Manton of Calcutta stock hooks similar in shape, but the points should be sharpened.

*Float.*—A piece of peacock quill 6" long, one end of which should have painted on it 2 narrow black bands  $\frac{3}{4}$ " apart, and the other end furnished with a loop of thin twine for fixing it to the running line. This is commonly known as Thomas 'Detective' float, but was actually in use centuries before Thomas came to India.

*Bait.*—The first consideration is ground bait.

There are various spices and concoctions, some unmentionably filthy, used for attracting fish, but after considerable experiment I have ruled out all except the following as being essential or desirable:—

- (a) Mustard seed oilcake— $\frac{1}{2}$  lb.
- (b) Maithee seed—1—oz.
- (c) Groundnut—4 ozs.
- (d) Yellow clay—1 lb.

Pound the oilcake and roast it in an old frying pan until it smokes slightly.

Grind maithee seed and groundnut separately and roast until of a rich, brown colour.

Mix these ingredients with the clay which should have been powdered in a dry state, add water, and knead to a stiff consistency. Break this mixture into lumps the size of billiard balls, and throw into water  $\frac{1}{2}$  an hour before actually fishing, and just where the hook will rest at the bottom.

*Hook bait.*—From June to end of July during the first showers and when water is discoloured, earthworms are as a rule—there are exceptions—readily taken by Rohu and Mirgal. August to end of October, after which tank angling is useless in Bengal, the bait *par excellence* is 'Maitah' or 'Meotah.' Country liquor in Bengal is brewed from fermented rice, and the residue left over after the liquor has been strained off is called Maitah. This should be squeezed on the hook in a lump the size of a marble, and the line carefully lowered into the water. Maitah is soft and flakes off readily, and this should be borne in mind when a fish nibbles.

*Depth at which to fish.*—This is most important. The hook and a single shot fixed on the snood 6" above the hook should just rest on the bottom, and the float regulated on the line so that only the bands painted on it appear above water.

Care should be taken to choose a spot where the water is from 3' to 5' in depth, and if there are reeds and grasses between the point of the rod and the angler, so much the better. I have heard it advocated that the deeper one fishes the better. This is I think distinctly wrong. Fish particularly towards evening, are inclined to browse amongst the reeds in the shallows and when the water is discoloured. I have hooked a 36-lb. Cutla in 2½' of water.

*When to strike.*—It is usually possible to determine from the behaviour of the float, and occasionally from bubbles rising round it, the species of fish in the swim. A Mirgal sends up a burst of small bubbles, a Rohu fewer and larger, and a Cutla one or two very large bubbles. When a Mirgal accepts the bait, the float after one or two slow bobs sometimes disappears from sight.

A Rohu after several bobs usually raises the float well out of, and sometimes lays it flat in the water. Strike to this movement, and the fish is a gift. A Cutla after one or two bobs twitches the float rapidly. Strike hard and quick, and with luck 70 yards of line will be torn off the reel after which a stubborn fight will follow. On one occasion I saw a Bengali Babu strike and play a Cutla from 3 to 5-30 p.m. during which time the line off another man's reel was brought into requisition. The fish scaled 68 lbs. On yet another occasion I watched a struggle with a Cutla from 4 p.m. to 7 p.m. when eventually the sorely tried hook broke off at the barb and the darkness of night swallowed the profanities of an exhausted fisherman.

As a rule when a Rohu is struck he springs clear out of water and then dashes off at a speed which would seem to indicate an urgent engagement elsewhere. He has not however the Scottish dourness of the Cutla. The Mirgal bores deep, but his first rush is not to be compared with that of the Cutla or Rohu. When fishing in tanks equally stocked with Cutla, Rohu and Mirgal one's proportion of fish taken in a season would be approximately Cutla to every dozen or more Rohu and Mirgal. The Cutla is a finicky brute, and in spite of his big head and mouth he is the daintiest of feeders and a thief so one must not expect to meet very many of these fine fish. The Bengalis have interesting method of fishing for Cutla which I have on occasion seen successful. This method is called 'Char-Kati' and is a poaching dodge pure and simple, but possibly excusable when Cutla of 50 lbs. and more are sucking surface weeds, and no bait however tempting will induce them to accept it.

Strips of bamboo are woven to form a hollow shell, the size and shape of a large cocoa-nut, and a thin bamboo some 6' in length passed through it. This shell is filled with boiled rice, spices and 'Maitah' after which one end of the bamboo is thrust into the soft mud at the bottom of the tank leaving the other end protruding about 1' above water. The angler then seats him-

self with rod and line to which are attached 2 or 3 hooks very square in the bend and known as Cutla hooks, and watches the end of the bamboo.

When this twitches it indicates a fish nosing around and trying to get at the tit bits in the bamboo shell.

The hooks are carefully lowered until approximately under the fish, when a hard strike may result in it being foul hooked (Fig. 9)."

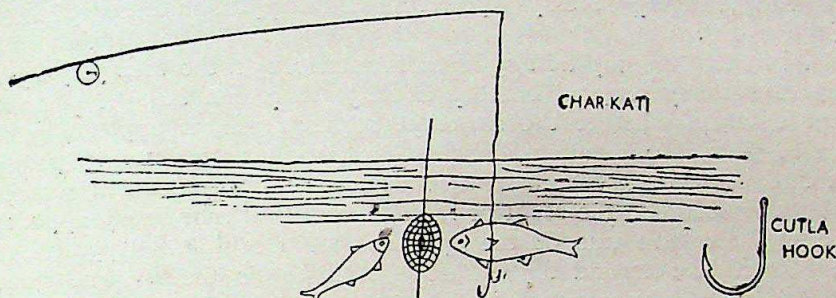


Fig. 9.—The 'Char-Kati' in action.

I have little to add to these notes except to say that a sound knowledge of the Code of the peacock quill, perfect co-ordination of eye, brain and wrist and patience in broiling sun or pouring rain are essentials to success in tank angling. The man who would 'chuck and chance it' had better stick to his spoon and rapid in some brawling Himalayan stream.

(To be continued.)

## THE SENSE OF SMELL IN SNAKES.

BY

CAPT. ALLEN PAYNE.

(With 2 plates and 1 text figure.)

### INTRODUCTION

The senses in the order Ophidia are very interesting, inasmuch as one finds according to the demands of food, protection, social life and the like, that one or more of the senses is to some extent exaggerated to compensate for the lack of, sometimes complete lack of, a particular sense.

This is most conveniently illustrated in the case of snakes by the fact that although a snake has no external auditory meatus and is to all intents and purposes quite deaf, they do possess a most uncanny sense of so-called 'hearing'. This is probably due to a very highly developed sense of 'feel'; nerve endings in the epithelium, scales and rib endings are developed in *excelsis*, even to the extent of recording minute vibrations. This high development and distribution of the nerves together with a very keen power of sight and extensive field of vision, is without doubt compensatory for the snake's deprivation of a sense of hearing.

Some years ago I interested myself in the sense of taste in snakes. As I was at that time in the United Kingdom, my speci-

mens were mainly obtained through the kindness of Dr. Burgess Barnett, at that time Curator of Reptiles at London Zoo. I was able to obtain python's heads from which I removed the tongues and prepared histological sections. These stained with haematoxylin and eosin did not lead me to believe that the python possessed any appreciable sense of taste as there was no evidence of the presence of taste buds in the epithelial layers. No doubt there is some other more highly developed power vested in pythons to compensate for this too.

A. F. Abercromby writing from Travancore on the 12th July 1921 to the Bombay Natural History Society<sup>1</sup> mentions that 'it is however doubtful whether the snake possesses much, if any, sense of taste'. He also mentions instances of snakes swallowing pieces of cloth and in one case a stick, which had recently been in contact with and absorbed the scent of rats. A most extraordinary appetite and palate! He was of the opinion that the snakes appreciated the smell of rats and took these articles to be them. The same writer records an incident of a python seizing and swallowing a rug. These observations however, do suggest a very powerful sense of smell in snakes.

It is well known from field observations that certain snakes quite definitely stalk their prey. The snake will be seen to make a meandering course, frequently flicking its tongue at objects and then proceeding on its way; eventually the snake will catch up with its objective and then depend on its keen visual powers and agility to effect capture.

Opinions are divided when it comes to the true function of the tongue, but in my opinion quite strong evidence is at hand to suggest that one of its major functions is the conveyance of scent spours through the palatine openings into the internal nares.

In the same communication, Abercromby says, 'at any rate the tongue appears to act as the carrier of the scent to the nostrils'.

Reference should also be made to a most interesting paper presented by A. G. L. Frazer, I.M.D., on 'The Snakes of Deolali',<sup>2</sup> which includes an item, 'Note on the peculiar use made of the tongue by snakes and some lizards'.

He writes: 'A striking feature in the behaviour of a snake is the peculiar use it makes of its tongue. The cause of this seemingly purposive act is not generally understood. . . . The habit as noticed amongst the Ophidia synchronises with the exercise of muscular activity, such as locomotion, or when in the case of the cobra, the hood is expanded and the anterior third of the body is erected. It is only in these active states that the creatures shoot out the forked tongue in quick succession. The act appears to be in the nature of a physiological expression of some function serving to their benefit. The author is unaware of any scientific explanation for this characteristic behaviour. Any theoretical consideration offered in elucidation of the act must necessarily be advanced on some physiological ground. . . . Snakes being cold-blooded, their

<sup>1</sup> *Journal, Bom. Nat. Hist. Soc.*, vol. xxviii, p. 812.

<sup>2</sup> *Journal, Bom. Nat. Hist. Soc.*, vol. xxxix, p. 58.

temperature varies with the surrounding medium and is normally a degree or two above it. Any muscular output is always attended by heat production in the tissues and there must be some means for eliminating the heat engendered, especially in an animal which is totally unprovided with sweat glands. In view, therefore, of the fact that the act is a spontaneous one and associated with muscular activity alone, there are tenable reasons for believing that the heat formed in the tissues is got rid of by evaporation of the moisture from the extruded surface of the tongue.

This is yet another theory of the function of the tongue, but I feel that the tongue has a more powerful role to fulfil in the life of snakes and it was the idea that the tongue is very closely connected with the olfactory organ that activated my interest to study the subject.

The following paper is a short study then, of the sense of smell in snakes, carried out over a period of about a year. The area from which I have drawn my specimens has been the United Provinces—mainly Lucknow district—and the species I have dealt with throughout the study has been the Common Krait (*Bungarus caeruleus*) as these are in abundance in this area and as I had promised to collect them in numbers to send to the Haffkine Institute, Parel, for antivenine research.

The major part of the investigation is based on twelve males and twelve females captured at village Kakori, U.P. The ages ranged between one year and two and a half years, and the males were between about three and four feet in length and the females two to three feet eight inches.

To make the discourse and the diagrams more clear, I have outlined very briefly the general anatomy and physiology of the organs of smell in snakes, and made special anatomical and histological observations in the case of *Bungarus coeruleus*.

#### Anatomy.

In any living creature the gustatory apparatus proper accommodates four main sensations, namely sweetness, salt, sourness and bitterness. These four sensations are but a mere portion of the wide range of sensations generally classified as taste. The appreciation of taste and smell is jointly derived from the sense of smell, which is subserved by the olfactory nerve.

Generally the organs of smell are two rather irregular chambers enclosed by the nasal capsules. These chambers are paired and separated by the nasal septum and are communicated with the internal nares; the linings of which are in connection with the olfactory nerves of each appropriate side.

In Ophidia, Jacobson's glands are present; these are situated between the nasal sacs and the palate, that is to say, between the turbinates and the vomer. They appear as a pair of sacs having an olfactory epithelium, and are actually outgrowths of the nasal sacs, innervated by the olfactory (and trigeminal). They open into the mouth immediately in front of the choanae and as such are consi-

dered as secondary olfactory organs specifically developed to serve the mouth. (See plate and diagrams of the mouth and skull.)

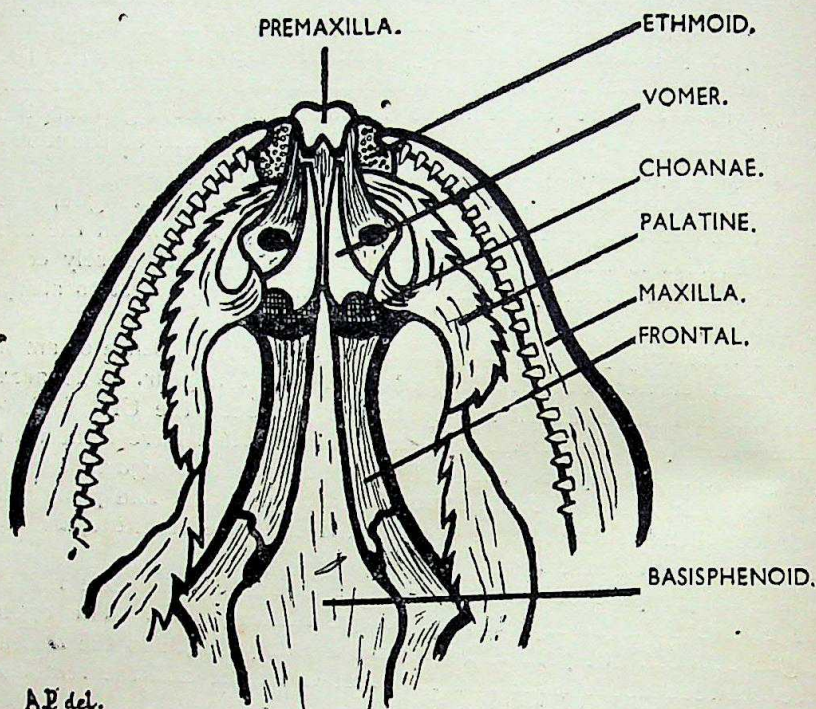


Fig. 1.—General idea of the anterior aspect (ventral) of a snake's skull showing the relationship of the vomer and choanae.

#### *Anatomy of Bungarus caeruleus.*

The general anatomy of the olfactory organ and its complimentary structures is not exceptional in the case of the Common Krait. An anterior palate, made up of thin tissue forming a sort of roof, is stretched across between the maxillae. Its length completes about one-third of the total tooth bearing maxillae and is rather short.

Leaving a space of about one-eighth of an inch above this, lies the roof of the mouth and the palate proper. Behind this tissue roof are the openings into the internal nares and the connections with the nostrils. (See plates.)

#### *A note on nervous tissues.*

Nerve tissue is made up of a series of cells which have the power of not only receiving but also interpreting stimuli. These cells are neurons and have a main body, a nucleus and radiating from the whole are many tails called dendrites with one particularly long dendrite known as the axon. It is along the axon that the nerve impulse passes. The axon eventually breaks up into tufts of many branches (terminal arborisation) and it is from here that the axon passes on the stimulus to either another cell or to fibres within the muscle, whence it is conveyed to the central nervous system. The axons sometimes become very long and come

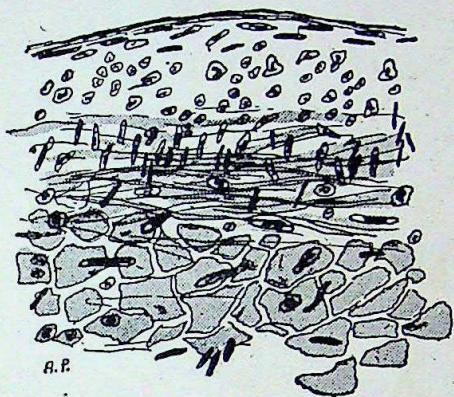


Fig. 1.—Longitudinal section through the tongue of *Bungarus caeruleus*. (Note absence of taste buds.)

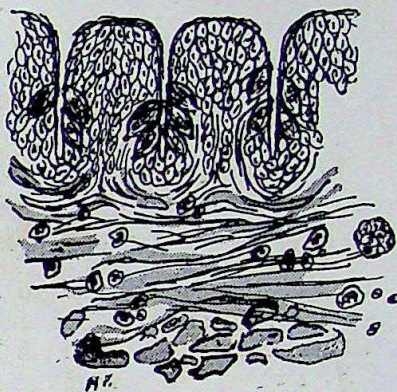


Fig. 2.—Longitudinal section through tongue of a rabbit showing taste buds in the epithelium.



Fig. 3.—Portion of a longitudinal histological section of a piece of olfactory tissue from *Bungarus caeruleus* showing nerve fibres in section and bundles.

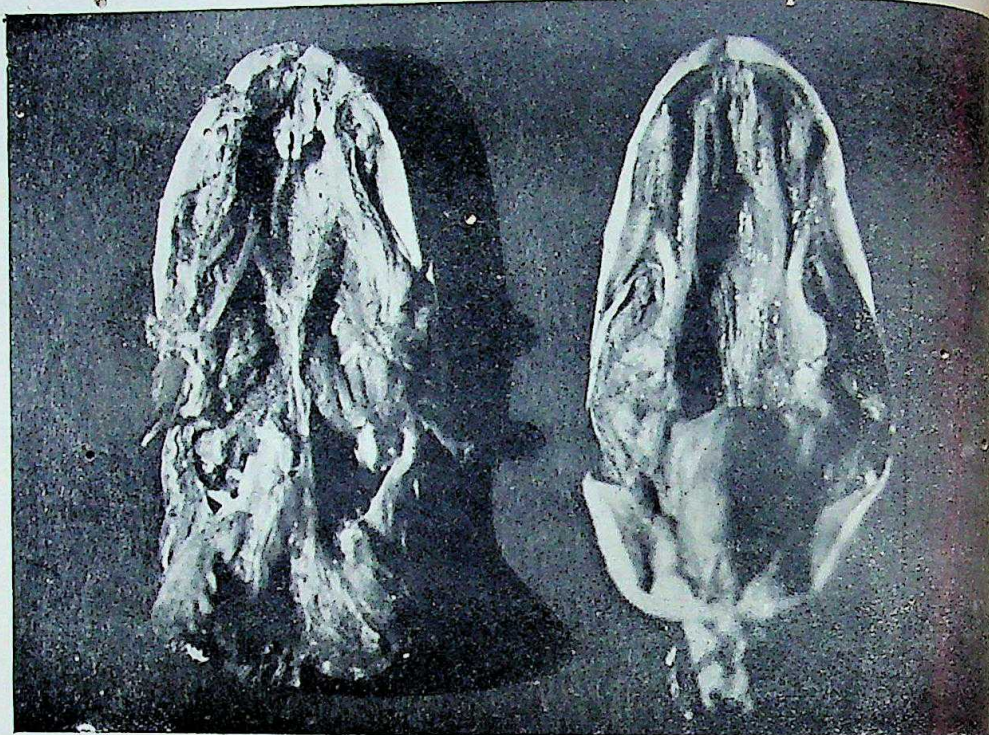


Fig. 1.—Photograph of the palate of the Common Krait (*Bungarus caeruleus*). A. Dissected. B. Natural. See explanation below.

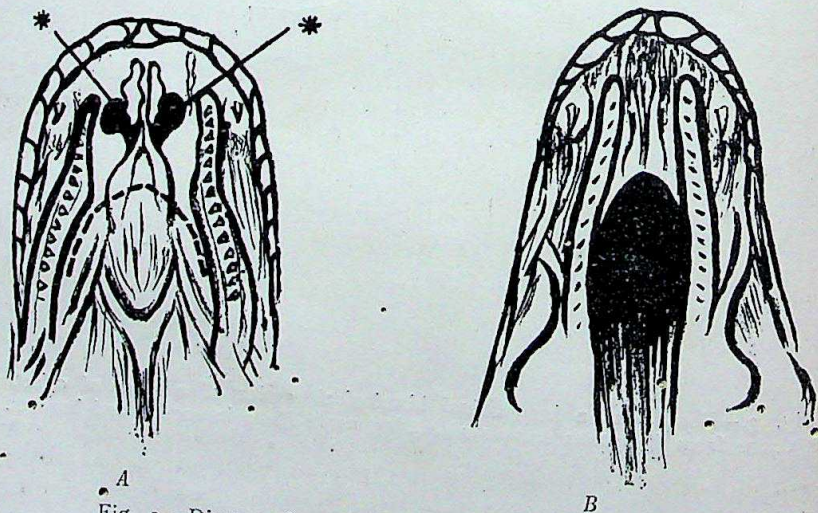


Fig. 2.—Diagram in explanation of the photograph above.  
A.—This shows the palate after the removal of the arch of tissue covering the openings into the nares (dotted line shows the original position of it). The openings into the nares are marked \*.  
B.—The natural palate showing the arch and the cavernous appearance of the roof of the mouth going beneath it.

together to form nerve fibres of which some tissue is made up. Usually the sense cells in the epithelium have a supporter cell lying on either side of them.

#### *Physiology.*

When air containing odorous particles is drawn through the nostrils or the mouth into the olfactory chambers, the cells known as receptor cells (which are particularly irritable to certain stimuli and line the nasal chambers) react to these odorous particles and the stimulus is passed to the afferent fibres, that is to say, those which pass through the dorsal root or one of the sensory cranial nerves, from whence they conduct the particular stimulus to the central nervous system.

A sensation is thus recorded.

#### *Histology.*

Specimens were dissected from the heads of both the male and female kraits and these were histologically sectioned as thinly as was possible and stained with haematoxylin and eosin and the nervous tissue stains.

First of all the tongue was sectioned (see plate) and this was compared with that of a rabbit. There were no traces whatsoever of any taste buds in the tongues of the snakes to suggest a sense of taste in these creatures. The plate will readily show the taste buds in the section of the rabbit's tongue; they lie within the epithelial papillae.

The snake's tongue demonstrates a wealth of epithelial cells and some muscular tissue.

Next, the olfactory was sectioned and proved to be most interesting on examination. Both the olfactory lobe and a portion of the nasal tissue were examined.

Generally the surface showed evidence of cross-sectioned nerve bundles overlaying many small granule-like cells with a few nerve fibres running in between them.

Dotted about the entire centre of the organ were many large nerve cells and although the sections were rather thick it appeared that these large cells were held together by strand-like structures or fibrils which were no doubt made up from the cell dendrites. Beneath these large cells many bundles of nerve fibres were seen containing a medley of cells.

The organ as a whole appeared to be well endowed with nerve cells and fibres and suggested a quite highly developed and efficient working olfactory organ.

#### EXPERIMENT NO. I.

##### *Sensitivity Tests.*

A box was prepared, having a glass front and being divided centrally into two chambers. The dividing piece had in one bottom corner an aperture 3 inches by 3 inches, over which was hung a piece of damp cloth to cover it.

For the purpose of the experiments the left-hand chamber is to be known as 'A' and the right 'B'.

The tests were carried out between about 8 p.m. and 8 a.m. In chamber 'A' a bowl containing slightly warmed concentrated Formaldehyde was placed and a male krait was also put in the same side. The vapour from the Formaldehyde did not appear to embarrass the snake for some time; the next morning, however, the krait had moved its abode by means of the aperture and was seen to be in chamber 'B' which was well ventilated. The experiment was repeated several times with males and females and most of them moved to the neighbouring chamber. Three died in chamber 'A', two being females.

I attribute the delay in any reaction to the fact that snakes appear to have the power of 'cutting off' their respiratory system on receipt of an unpleasant stimulus (Formaldehyde is more of an irritant than a bad smell) and also to the fact that the Formaldehyde vapour was of insufficient strength to more than irritate the nasal membrane in the first instance.

Similar experiments were carried out with other commodities and a table is appended to show the reactions.

Table showing the various reactions of *Bungarus coeruleus* to the given commodities.

Commodity	Snake	Sex.	Reaction
Formaldehyde ... ..	BUNGARUS COERULEUS.	5 ♂	4 from A to B. (1 died in A).
		5 ♀	2 from A to B. (2 died in A). (1 remained in A).
Decomposing vegetable matter...		4 ♂	Nil.
		4 ♀	Nil.
Petrol, Turpentine, Pyridine ...	BUNGARUS COERULEUS.	4 ♂	2 from A to B.
		4 ♀	Nil.
Fresh wild flowers	BUNGARUS COERULEUS.	5 ♂	1 from A to B.
Decomposed fly-blown krait		5 ♀	Nil.
covered with maggots		6 ♂	All to Chamber B. (Apparently to escape the maggots.)
Sulphur fumes ... ..	BUNGARUS COERULEUS.	3 ♂	2 from A to B. (1 died in A.)
		3 ♀	1 from A to B. (2 died in A.)

There is no conclusive evidence that the movements were due to the snakes recording a bad stimulus by means of the olfactory organ but it is interesting to note that the males appeared more reactive than the females.

Samples of the commodities soaked into cotton wool and placed on the end of a stick were held over the nostrils of the snakes and the reactions were generally that the snake hid its head in its coils.

If the tongue actually touched the commodity the reaction was certainly more pronounced and rapid.

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## EXPERIMENT NO. 2.

On February 4 two of my specimens were seen to be locked in coitus. The female was removed and the anal scent glands were carefully dissected. The dark black creamy substance therefrom was then removed and a line of it was streaked from 'A' to 'B' through the aperture:

The male krait was placed in chamber 'A'. After about three hours he was seen to be in chamber 'B' exploring. This experiment was not repeated.

Whilst I do not believe that the anal gland has any significance sexually, as I do not perceive any macroscopical or histological change in it, and as insufficient data is available to prove that it is by this means that the male detects its mate,<sup>1</sup> I do feel that the krait was appreciative to the particularly pungent smell of the excretion from the glands.

Later, a corner of another box was smeared liberally with the same substance from the anal glands and be it by choice or coincidence, the entire kraits contained therein coiled themselves in that corner and if moved soon returned to the same spot.

Mr. S. H. Prater in his article 'The Social Life of Snakes' (*J.B.N.H.S.*, vol. xxxvi, p. 475) suggested that the function of the anal glands may be in the locating of the female by the male during the breeding or mating season; he adds that these problems require further elucidation.

Colonel Wall on the same subject writes: 'Anal Glands.—The anal or scent glands secrete a blackish material of the consistency of a soft ointment. This has a peculiar, rather disagreeable, but not very penetrating smell. The glands in the both sexes are active at all seasons, and at all stages from the time of hatching, so that I am inclined to question the popular belief fostered by Darwin (*Descent of Man*, p. 539) among others that they are concerned with the sexual functions.'

*Conclusion.*

From the anatomy of the palate and the olfactory organs it appears that there is a definite functional link between the two. The presence of the tissue stretched across between the palate and the mouth is suggestive of an attempt to collect odorous particles which enter the mouth by means of the tongue. The vapour therefrom would be conveyed through the narial openings to the internal nares lined with epithelium innervated by the olfactory.

In this connection the tongue undoubtedly plays an important role in being the method of transport of the odorous particles to the narial openings.

From the histology it would appear that the tongue has no appreciable sense of taste. Experimentally it is observed that although there is some reaction to certain commodities touched by the tongue, this reaction is due largely (that is, when the com-

<sup>1</sup> I have frequently dug for Kraits and found male and female paired during hibernation.

modity was not an irritant) to the tongue conveying the particles of the commodity to the olfactory organ and thereby setting up a stimulus.

This method of the appreciation of smell in snakes is, I think, as well developed as the method of through the nostrils'.

I do not consider that the snake places its tongue over the nostrils in order to deposit odorous particles. I admit that particularly with the larger snakes and lizards too, the tongue becomes so unwieldly that on the tongue being withdrawn it tends to flap, thereby giving the impression that it is 'licking its nostrils'.

It appears, then, that the snake is endowed with a very efficient organ of smell and that this is used in all phases of its life.

The olfactory mechanism including the nostrils is reinforced by the action of the tongue, which may be considered as a secondary olfactory organ, inasmuch as it conveys the odorous particles through the mouth to the palatine nares openings. I suggest that the majority of the flicking in and out of the tongue is done with the object of collecting these odorous particles for identification by smell. In this way the snake may often be mistaken and this would account for its most extraordinary tastes at times.

I do not find that the belief that the tongue serves as a sweating apparatus to regulate the heat engendered in the body by muscular action, very tenable, as in the number of histological sections I have examined I do not perceive any trace of sweat apparatus nor do I see any relative tissue.

The findings of this short study tend to support the theory that snakes are by no means anosmic but they can and do differentiate very considerably between the various smells, and that they use this sense very largely during the process of their lives.

#### Appreciation.

My very grateful thanks are due to my friend Capt. (Miss) Margaret Hamilton, R.A.M.C., for her kind criticisms and assistance and also to Major C. Lyn Greening, I.M.S., Director of the District Laboratory, Lucknow, for allowing me all facilities, for the preparation of the histological sections and for his advice.

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#### EXPLANATION OF PLATES.

##### PLATE I.

- Fig. 1.—Longitudinal section through the tongue of *Bungarus caeruleus*. (Note absence of taste buds.)
- Fig. 2.—Longitudinal section through tongue of a rabbit showing taste buds in the epithelium.
- Fig. 3.—Portion of a longitudinal histological section of a piece of olfactory tissue from *Bungarus caeruleus* showing nerve fibres in section and bundles.

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## PLATE II.

Fig. 1.—Photograph of the palate of snake (*Bungarus coeruleus*).  
 'A', Dissected. 'B', Natural.

Fig. 2.—Diagram in explanation of the photograph above.

A.—This shows the palate after the removal of the arch of tissue covering the openings into the nares. (Dotted line shows the original position of it.) The openings into the nares are marked \*.

B.—The natural palate showing the arch and the cavernous appearance of the roof of the mouth going beneath it.

## A GENERAL REVIEW OF THE MARINE ALGAE OF THE WESTERN COAST OF INDIA.

BY

KALIPADA BISWAS, M.A., D.SC. (Edin.), F.R.S.E.,  
*Superintendent, Royal Botanic Garden, Calcutta, and*  
*Honorary Lecturer in Botany, Post-graduate*  
*Department in Science, Calcutta University.*

(With 3 plates)

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## INTRODUCTION AND ACKNOWLEDGEMENT.

A paper entitled 'A note on the Algae collected by James A. Murray at Karachi' by Mr. S. C. Dixit, published in *Current Science*, Vol. 9, No. 1, pp. 27-28, 1940, prompted me to undertake searching for the old species of marine algae of the coasts of Bombay and Karachi. This search led to several important discoveries on the question of distribution of the marine species of the western coasts of India. It was also discovered that certain observations made by Mr. Dixit on Murray's collections needed modifications as dealt with in the first paper. The interest thus created urged the writer to undertake a survey of all the species of marine algae of the coast line of Bombay Presidency known up to the present time. The result of this survey is embodied in brief in the general review of my paper. Recent investigation by Dr. P. L. Anand, M.Sc., Ph.D., of the Punjab University, as reported in his contribution on 'Marine Algae from Karachi', Chlorophyceae, Pt. I, 1940 and Rhodophyceae, Pt. II, 1943, led to the discovery of a few new records and new species. These however have since been published. So far my examination of these species reveals their record from this part of the sea is not likely to alter materially my observations on the distribution of the marine algae of this part of India.

I express my indebtedness to Mr. Gopal Chandra Mitra, M.Sc., for his valuable assistance in the preparation of this paper.

## REVIEW OF PAST WORK AND COLLECTIONS OF INDIAN MARINE ALGAE.

Collection of Indian algae can be traced from as early a period as 1798. Records show that marine algae growing along the coastline of India were gathered about 60 years earlier than the period of Murray's collection at Karachi. Wallichian sheets of marine algae (Wall. Cat. Nos. 7481, 7482, 7483, 7484, 7485, 7486, 7487, 7490) from the Andaman Islands, Penang and Singapore were collected in 1822. These algal materials can be taken as the oldest specimens of marine algae collected and preserved in India for the last one hundred and twenty-three years. Therefore collection and study of marine algae of the Indian seas date from 1822 onwards. Dr. Alexander Braun and Dr. W. Hervey mentioned in 1826 about Belanger's and Wight's collection of Chara and sea-weeds. Belanger was an ardent admirer of the treasures of the Indian seas. In 1836, as Director of the Botanic Gardens in Pondicherry, he collected sea-weeds along the coasts of Cape Comorin and its neighbourhood in South India. James Forbes Royle, late of medical staff of the Bengal Army, published a short note on algae in his monumental work on the 'Illustrations of the Botany and other branches of the Natural History of the Himalayan Mountains and of the Flora of Cashmere' in Vol. 1, pp. 441-42, 1839, where Royle suggests that the *Dictyoteae* increase in numbers as we approach the equator; and *Hypnea*, *Cystoseria*, *Sargassum*, *Zonaria*, *Spharococcus*, *Thamneria*, *Acanthiophora*, *Tamnophora*, *Amansia*, *Caulerpa* and *Gelidium*, of which swallows build the so much prized 'edible bird's nests' abound in tropical seas. Few have been described from the Indian Ocean, but several are contained in Dr. Rottler's Herbarium.' He also mentioned that 'A few species of Confervas' are found in Dr. Rottler's Herbarium from the neighbourhood of Tranquebar. Dr. W. H. Hervey described three charming sea plants in 1854 from the south coast of Ceylon under three genera. The three species mentioned by him are *Vanvoorstia spectabilis*, *Claudea multifida* and *Martensia spectabilis*. The genus *Vanvoorstia* was named after the reputed naturalist John Van Voorst, author of the Natural History of Great Britain. This genus was established for the first time by Dr. Hervey. Reports on the marine algae of Ceylon—Ecological and Systematic studies of the Ceylon species of *Caulerpa* by Dr. Niks Svedelius of Upsala published in the Biological Results of the Ceylon Fishery, 1905, is a valuable contribution towards our knowledge of marine flora of India and Ceylon. The original set of Hervey's collection of Ceylon algae is preserved in Trinity College, Dublin. The duplicates are available for study at the Royal Rik's Museum in Stockholm and in J. G. Agardh's Herbarium in Lund. A few stray sheets are in the Calcutta Herbarium mixed up with Fergusson's specimens. (1) The earliest collector of sea-weeds of Karachi is not J. A. Murray but Vice-Admiral W. J. S. Pullen who gathered some interesting specimens of marine algae from Karachi proper in 1859-60. A large number of valuable well-preserved old sheets of Wallich (1822), Hervey (1853), Anderson (1861), Kurz (1867).

Fergusson (1875), J. A. Murray (1881), King and Prain (1889-90), Heinig (1896), Gardiner (1899) and others are in the Calcutta Herbarium under the safe custody of Government. Prof. Borgesen visited India at the invitation of the Bombay University and during his stay in this country from the middle of December 1927 to the end of January 1928 made a fair collection of algae from the Bombay coast with the help of Messrs. S. C. Dixit, C. Ayengar and K. G. Naik. These were subsequently worked out by Prof. Borgesen in Copenhagen and the result published mostly in the Journal of the Indian Botanical Society and Kew Bulletin. I am not aware if the original set of this collection is in the Bombay University or elsewhere in India. If not, steps should be taken to obtain for India the original or at least the duplicate set of this collection including the type or cotype sheets of the new and unrecorded species discovered in this collection.

A set of 39 excellent Herbarium sheets of Murray's original algal specimens from Karachi collected in 1881-83 and preserved at the Herbarium of the Royal Botanic Garden, Calcutta, proves that Mr. Dixit's inference that 'it is a loss to science that Murray's first collection is not preserved in the country' as mentioned in his note on the algae collected by James A. Murray at Karachi, in *Current Science*, Vol. 9, No. 1, pp. 27-28, January 1940, is also not based on sufficient authentic information. Any algologist dealing with sea algae cannot but doubt the accuracy of the determination of algae mentioned in Murray's book on 'The Plants and Drugs of Sind'. In this book under class I, Thallogens Alliance 1. Algalis Murray records under 3 Natural orders 22 species representing 14 genera. It is expected that if these algae were correctly identified at least some of the species would have been mentioned in Prof. Borgesen's works which were based on Murray's Karachi algae located in the Kew Herbarium and the Herbarium of the British Museum (Natural History), London. There would also have been some of Murray's species represented among the Calcutta set of his Karachi algae, 25 per cent of which are found among the Herbarium materials at Kew. The Calcutta Herbarium possesses a set of well-preserved sheets of Murray's algae which were sent to the late Sir George King some time in 1884 or thereabout evidently for naming. Of these excepting six species which are both in Kew and in Calcutta collections the rest of the Karachi specimens of Murray at the Calcutta Herbarium do not seem to have been reported so far. Examination of Murray's list of algal specimens reveals that there is much confusion in the nomenclature too. Out of 22 species noted in Murray's book only one species, *Ceramium rubrum* (Huds.) Ag. var. *virgata* Ag., is reported by Borgesen with the remark that 'two well-preserved specimens of this form of *Ceramium rubrum* widely spread in the Arctic Sea and in the northern Atlantic Ocean are present in the collection of Algae belonging to the Kew Herbarium. Their occurrence in the Arabian Sea is therefore rather astonishing'—Kew Bull., No. 1, p. 19, 1934. This species Borgesen reported again in his exhaustive paper on Karachi algae entitled 'Some Marine Algae from the Northern Part of the Arabian Sea with remarks on their geographical distribution'.

(published in Det. Kgl. Dansk. Viden. Sel. Biolog. Medd. Vol. xi, No. 6, p. 41, 1934) with locality 'India, Karachi'. He however omitted this species in his subsequent paper on 'A list of Marine Algae from Bombay' (published in Ibid., Vol. xii, No. 2, 1935) as he was then definitely doubtful about the occurrence of some of the northern species which were incorporated in his previous lists by mistake and he explained this fact in his footnote to the paper. Further it cannot be imagined how the northern temperate species of *Laminaria saccharina* (L.) Lam. was found by Murray in Karachi. The family Laminariaceae is confined entirely to the north temperate regions. It is equally puzzling to account for the range of distribution of the species *Laminaria saccharina* as noted by Murray in his book 'from the Caspian into India. In the Thibet it is said by Honigberger (a medical man) to grow in Salt Lake'. This species is distributed in the northern part of the Atlantic and the Pacific Ocean. From the above facts it becomes clear that Kirtikar and Basu are not far wrong in doubting the specific determination of the plants catalogued by Murray. They in their work on Indian Medicinal Plants, Pt. I, p. xiii, para 3, 1918 (Introduction) remark that 'Murray neither being a medical man nor a skilled botanist compiled his work from other sources and, as such, the work is of doubtful value'. The literature and the authorities consulted by Murray leads any botanist to the same conclusion. Moreover, the range of distribution of many of Murray's sea algae hitherto recorded in standard works shows that it is extremely unlikely that some of his northern species as noted in his contribution can possibly find their abode in Karachi. Prof. Borgesen therefore in the concluding sentence to his discussion on the geographical distribution of the algae of the northern Arabian Sea remarks that 'it would be of great interest to confirm the presence of the above mentioned northern species found there by James A. Murray according to his collection in the Kew Herbarium'. Extracts quoted above by Mr. Dixit from Borgesen's paper in support of his argument is therefore rather misleading. The full paragraph relating to the point is as follows:—

'But the most important result of the examination of the collection of the British Museum was to establish that none of the northern and arctic algae mentioned in my list were found in the collection. When I heard that the British Museum also possessed a large collection of J. A. Murray's Algae from Karachi I was of course especially interested in finding out whether the northern species were found there too. This not being the case greatly increases my doubts as to whether they really live there, and seems to me to render it probable that they have come into Murray's collection found in the Kew Herbarium by mistake.' The specimens of James A. Murray as noted in his book are not likely to be lost to science but the confusion is due to their wrong identification. This explains the reason why the specimens mentioned by Murray are absent in the collections of his Karachi algae at Kew, British Museum and Calcutta Herbarium. Consequently the species as named in Murray's book are also not found in Borgesen's works on Karachi algae including Murray's original materials. Thus it

follows that the original collection of Murray is not only at the Kew and British Museum but also in the Calcutta Herbarium evidently under different names. These algae have already been worked out by Prof. Borgesen. Mr. Dixit therefore need not burden under the misapprehension that James A. Murray's collection of marine algae from Karachi is lost to science. It will also be obvious from the points discussed above that Prof. Borgesen simply asserts that some of the specimens of northern arctic algae, referred to in his paper on the Marine Algae from northern part of the Arabian Sea, found their access into J. A. Murray's collection at Kew Herbarium through mistake. These specimens wrongly placed with Murray's collection set Borgesen to speculate on the migration of some of the northern temperate species in tropical seas and to draw certain rather far-fetched conclusions while dealing with the geographical distribution of the marine algae on the northern part of the Arabian Sea. Some of Borgesen's arguments advanced to account for the occurrence of these northern specimens cannot be supported by previous data which established the dominating influence of Malayan and Australasian elements in the distribution of deep water and littoral algae in the tropical waters of the Indian Ocean. Borgesen's footnote, quoted above, to his paper on 'A list of marine algae from Bombay' where he points out his mistakes detected during his scrutiny of Murray's set of algae at British Museum (Natural History), London, is of greatest importance to oceano- and phyto-geographers and those interested in the distribution of sea-weeds. Some of his views expressed under the heading 'Some Plant Geographical Considerations' demand revision in the light of the distribution of species contained in the additional collection of James A. Murray's algae at the Calcutta Herbarium which he does not seem to have examined in dealing with the Bombay algae.

It will be obvious from the statement above 'how a wrong statement made by Borgesen led to misleading speculation about the geographical distribution of the flora and fauna in this part of the Indian sea. Sewell states, 'It has recently been discovered that a very high percentage of species of Marine Algae are common to the Indian Ocean and the North Atlantic Ocean, some even occurring in the Arctic region.' ('The oceans round India' by R. B. S. Sewell, p. 40, An outline of the Field Sciences of India, 1937). This statement is evidently based on Borgesen's observation on the geographical distribution of the algae of the northern Arabian Sea after Borgesen's comparison of Murray's sheets at Kew. 'It would be of great interest,' Borgesen however remarked, 'to confirm the presence of the above-mentioned northern species found there by James A. Murray according to his collection in the Kew Herbarium.'

#### DISTRIBUTION OF MARINE ALGAE OF THE BOMBAY COAST LINE.

The total number of species and varieties known to us from the western coast of India is 255, representing 5 species of Myxophyceae, 81 of Chlorophyceae, 38 of Phaeophyceae and 131 of Florideae. Endemic species, varieties and forms are only 45, thus representing only 17 per cent of the algae recorded from this area of

the seashore of the Peninsular India. South-Western Australia has many species common to the Malayan Archipelago. Hence from the point of view of algal distribution the part of the water bordering the south-western coast of Australia may very well be considered botanically as a part of the Malayan Archipelago. The south-eastern element therefore becomes predominant in the algae of the western coasts of India as this element represents approximately 50 per cent of the Malayan and South-West Australian species, while the Atlantic or north-western element including Europe, Africa and the Mediterranean element is about 33 per cent.

Some of the Malayan species evidently migrated to the Arabian Sea from the Pacific and the Indian Oceans with the oceanic currents and ships calling at the port of Bombay. Climatic and biotic factors might have thus influenced the passage of many overseas western and eastern species into the Arabian Sea and their subsequent acclimatisation along the coastline of Bombay and Sind. The inference is based on the analysis of the species as illustrated in detail in the following table showing regional distribution of the species:—

The table shows the regional distribution and percentage of the different species recorded from the Bombay Coast.

	Bombay coast	Percentage
West Indies and America (Atlantic coast)	101	39.6
Europe and Africa (Atlantic coast)	99	38.8
Mediterranean	77	30.2
Cape	36	14.1
Red Sea	70	27.4
Malayan Archipelago	103	40.3
S. W. Australia	73	28.6
Japan	80	31.3
N. E. Australia	38	14.9
Polynesia	70	27.4
America (Pacific coast)	52	20.3
Total number of species, varieties and forms recorded	255	...
Endemic species, varieties and forms	45	17.6

The census reveals, as already indicated by previous physiologists, that the Malaysian element is more dominant than the Atlantic. The difference however is not very great. This may be due to the geographical position of Bombay and Sind in the Eastern portion of the Arabian Sea. It remains however to be investigated how many of the species actually occur along the Bombay Coast and how many are migratory which simply float down to the Arabian Sea.

The question of the distribution of marine algae is more complicated than that of the higher plants. The problem of distribution of the Indian marine algae is dependent on ecological factors, physical and chemical nature of the water, hydrographical and biological conditions in the Indian seas, geological history of the land masses and periodicity and auto-ecology of the different species of algae representing the marine flora of the area under investigation. Our knowledge of the Indian Sea algae belonging to all the groups is far from complete, although some valuable works by distinguished physiologists exist. It is too early to draw any definite conclusion on the distribution of our marine flora.

A detailed field investigation and a careful study on the different aspects of the marine algae including *Diatomales* ranging for at least three different seasons are likely to throw light on many important questions such as distribution, nature of the growth and yearly production of the economic species. These data are of considerable value not only to science but also to the important question of utilising the marine vegetation of the Indian Coast line for commercial, agricultural and industrial purposes.

In order to have an approximate estimate of the marine flora of the Indian coastline extending over nearly 5,000 miles and the islands in the Indian Ocean, it is imperative that a systematic physiological survey on proper scientific lines should first of all be undertaken without further delay. Such a survey will form the basis of all subsequent studies. When the survey work is completed a detailed investigation should then be carried on by a set of scientists and industrialists in order to devise ways and means for utilising the useful species of sea-weeds and other marine flora in a suitable manner. The importance, therefore, of gathering necessary information on the Indian marine flora need not be emphasised.

Chart showing the range of distribution of the recorded species from Bombay seaside in different parts of the world:—

Name of species under each class of Algae	Atlantic Ocean				Indian Ocean				Pacific Ocean			
	West Indies, America	Europe, Africa	Mediterranean	Cape	Red Sea	India, Ceylon, Africa	Malayan Archipel.	S. W. Australia	Japan	N. E. Australia	Polynesia	America
<i>Myxophyceae</i>												
Microrcoleus Ichthonoplastes (Fl. Dan)												
Thuret		+	+			+						
Sirocoleus kurzii (Zell) Göm.		+	+			+	+	+	+	+	+	+
Lyngbya majuscula Harv.		+	+			+	+	+	+	+	+	+
Lyngbya confervoides C. Ag.		+	+			+	+	+	+	+	+	+
Lyngbya infixa Frey		+	+			+						
<i>Chlorophyceae</i>												
Enteromorpha compressa (Linn) Grev. var. typica forma campanulata Chapman						+						
Enteromorpha flexuosa (Wulf) J. Ag.	+	+	+	+	+	+	+	+			+	+
Enteromorpha intestinalis Kuetz. var. cornucopiae Kuetz.		+				+						
Enteromorpha tubulosa Kuetz.		+	+			+	+	+	+	+	+	+
Enteromorpha intestinalis Kuetz. forma tubulosa Chapman			+									

Name of species under each class of Algae	Atlantic Ocean			Indian Ocean			Pacific Ocean					
	West Indies, America	Europe, Africa	Mediterranean	Cape	Red Sea	India, Ceylon, Africa	Malayan Archipelg.	S. W. Australia	Japan	N. E. Australia	Poly nesia	America
Enteromorpha prolifera (Muell.) J. Ag.	+	+	+			+	+	+	+	+	+	+
Enteromorpha prolifera Ag. forma capillaris Chapman						+						+
Enteromorpha minima Naeg.		+	+			+					+	+
Ulva lactuca (L.) Le Jolis	+	+	+		+	+	+		+		+	+
Ulva reticulata Forsk			+		+	+				+		
Ulva indica sp. nov. Anand						+						
Ulva fasciata Delile	+	+	+		+	+	+					+
Ulva fasciata Delile forma taeniata Setch						+						
Endoderma leptochaete Huber		+				+						
Endoderma viride (Reinke) Lagerheim		+	+	+		+	+			+	+	
Endoderma Wittrockill (Wille) Lagerh.		+	+			+	+					
Valonia aegagrophila C. Ag.		+	+	+		+	+	+		+		
Valonia utricularis (Roth) Ag.		+	+	+		+	+			+		
Entocladia polysiphonia sp. nov. Anand						+	+				+	
Cladophoropsis sundanensis Reinbold						+	+					
Cladophoropsis Zollengeri (Kuetz.) Boergs.						+	+					
Pseuduevella sp.						+						
Boodlea composita (Harv. et Hook. fil) Brand												
Valoniopsis pachynema (Mart.) Boergs.	+		+			+	+			+	+	
Willelia ordinata Boergs						+	+					
Chaetomorpha prostrata sp. nov. Anand						+						
Chaetomorpha media (Ag.) Kuetz.	+					+	+	+			+	+
Chaetomorpha torta (Farlow) McClatchie						+	+	+			+	+
Chaetomorpha Linum (Muell) Kuetz.	+	+	+	+	+	+	+	+			+	+
Chaetomorpha indica Kuetz.					+	+	+	+			+	+
Chaetomorpha aerea (Dilw.) Kuetz.	+	+	+	+	+	+	+	+	+	+	+	+
Chaetomorpha clavata (Ag.) Kuetz.	+	+	+	+	+	+	+	+	+	+	+	+
Lola (?) capillaris (Kuetz ) A. et G. Hamel		+	+	+	+	+		+	+		+	
Rhizoclonium kochianum Kuetz.	+	+	+			+						
Rhizoclonium tortuosum Kuetz.		+	+			+						
Rhizoclonium implexum (Dilw.) Kuetz.	+	+				+					+	
Rhizoclonium grande Boergs.						+					+	
Rhizoclonium Kernerii Stockm.						+					+	
Cladophora colabense Boergs.	+					+					+	
Cladophora Fritschii Sp. nov. Anand						+						
Cladophora Fritschii Anand var. nov. Kermariensis Anand						+						
Cladophora saracenia Boergs.						+	+					
Cladophora fascicularis (Mart) Kuetz.	+					+	+					
Cladophora bombayensis Boergs.					+	+						
Cladophora Magdalene Harv.						+						
Cladophora monumentalis Boergs.		+				+						
Cladophora (Hutchinsiae ?) (Dilw.) Kuetz.	+	+	+			+						
Struvea delicatula Kutz	+	+	+			+						
Chamaedoris auriculata Boergs.	+	+	+			+	+				+	
Acetabularia Möbii Sokms-Labauch						+			+			

## A GENERAL REVIEW OF THE MARINE ALGAE

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Name of species under each class of Algae	Atlantic Ocean		Indian Ocean		Pacific Ocean							
	West Indies, America	Europe, Africa	Mediterranean	Cape	Red Sea	India, Ceylon, Africa	Malayan Archipelago	S. W. Australia	Japan	N. E. Australia	Polynesia	America
Acetabularia caliculus Quoi et Gaimard	...	+				+		+	+			
Bryopsis corymbosa J. Ag.	...	+	+	+		+	+	+	+		+	+
Bryopsis Plumosa (Hud.) Ag.	...	+	+	+		+	+	+	+		+	+
Bryopsis pennata Lamour. var. minor J. Ag.	...	+	+			+		+	+			
Bryopsis hypnoides Lamour	...	+	+			+					+	
Pseudobryopsis mucronata Boergs...	...					+					+	
Codium coronatum Setch	...					+						+
Codium tomentosum (Huds.) Stackh	...	+	+	+	+	+	+	+	+		+	+
Codium latum Sur	...	+	+	+		+	+	+	+			+
Codium elongatum Ag.	...	+		+	+	+		+	+			
Udotea indica A and E. S. Gepp.	...					+	+					
Siphonocladus sp.	...					+						
Halimeda Tuna (Ell. et. Sol.) Lamour	...	+	+	+	+	+	+		+	+	+	
Caulerpa taxifolia (Vahl.) Ag.	...	+	+			+	+		+	+	+	
Caulerpa scalpelliformis (R. Br.) Webb. v. Boss	...			+		+	+	+	+	+		
f. intermedia Webb. v. B.	...					+	+	+	+	+		
f. dwarkensis Boergs.	...					+						
Caulerpa sedoides (R. Br.) Ag.	...	+				+		+				
Caulerpa fastigiata Mont	...	+				+					+	
Caulerpa sertularioides (Gmel.) Howe	...	+	+			+	+	+	+	+	+	+
Caulerpa racemosa (Forsk) Webb. v. Boss. var. clavifera (Turn) Webb. v. Boss.	...	+	+	+	+	+	+	+	+	+	+	
f. typica Boergs	...					+						
var uvivera (Turn) Webb. v. Boss.	...					+	+					
f. condesata (Kuetz) Webb. v. Boss.	...					+	+					
var laetevirens (Mont) Webb. v. Boss.	...					+						
f. typica Web v. Boss.	...					+	+					
f. laxa (Grev.) Web v. Boss.	...					+	+					
var corynephora (Mon) W. v.	...	+				+	+	+			+	
Caulerpa peltata Lamour	...	+				+	+			+	+	
Vaucheria piloboloides Thur.	...		+	+		+						
Ostreobium Reineckei Bornet.	...	+				+	+				+	
Phaeophyceae												
Ectocarpus coniger Boergs.	...					+						
Ectocarpus Cylindricus Sanuders	...											
Ectocarpus Mitchellae Harv.	...	+	+			+						+
Myriogloea scurra (Harv.) Kuck.	...				+	+				+		
Gonodia arabica (Kuetz.) Boergs. n. Comb.	...		+			+						
Nemacystus decipiens (Suhr.) Kuck.	...					+			+			
Rosenvingea intricata (J. Ag.) Boergs.	...	+	+			+	+				+	
Rosenvingea orientalis (J. Ag.) Boergs.	...	+				+	+				+	
Colpomenia Sinuosa (Roth.) Derb. et. Sol.	...	+	+	+	+	+	+	+	+	+	+	+
Colpomenia Stellata (Boergs.) Boergs.	...					+	+		+	+	+	+
Hydroclathus cancellatus Bory	...	+	+		+	+	+	+	+	+	+	+
Sphacelaria tribuloides Menegh.	...	+	+	+	+	+	+	+	+	+	+	+

Name of species under each class of Algae	Atlantic Ocean			Indian Ocean				Pacific Ocean				
	West Indies, America	Europe, Africa	Mediterranean	Cape	Red Sea	India, Ceylon, Africa	Malayan Archipelg.	S. W. Australia	Japan	N. E. Australia	Polynesia	America
Sphacelaria furcigera Kuetz. ....	+	+	+	+	+	+	+	+	+	+	+	+
Spathoglossum asperum J. Ag. ....	...	...	...	...	...	+	+	+	...	...	...	...
Spathoglossum variabile Fig. et. De. Not. ....	...	...	...	...	...	+	+	+	...	...	...	...
Stoechospermum marginatum (Ag.) Kuetz. ....	...	...	...	...	...	+	+	+	...	...	...	...
Stoechospermum patens Hering ....	...	...	...	...	...	+	+	+	...	...	...	...
Stoechospermum ? maculatum J. Ag. ....	...	...	...	...	...	+	+	+	...	...	...	...
Zonaria variegata (Lamour.) Ag. ....	...	+	+	...	...	+	+	+	...	+	+	...
Padina tetrastromatica Hauck ....	...	+	...	...	...	+	+	+	...	...	...	...
Padina Fraseri (Grev.) J. Ag. ....	...	...	...	...	...	+	+	+	...	...	...	...
Padina Commersonii Bory ....	...	+	...	...	...	+	+	+	+	+	+	...
Phyllaria reniformis (Lamour) Rostaf ....	...	...	+	+	...	+	+	+	...	...	...	...
Dictyopteris acrostichoides J. Ag. ....	...	...	...	...	...	+	+	+	...	...	...	...
Dictyopteris australis Sond ....	...	...	...	...	...	+	+	+	...	...	...	...
Dictyota Bartayresiana Lamour ....	...	+	+	...	...	+	+	+	...	...	...	...
Dictyota dumosa Boergs. ....	...	...	...	...	...	+	+	+	...	...	...	...
Dictyota maxima Zanard ....	...	...	...	...	...	+	+	+	...	...	...	...
Dictyota Atomaria Hauck ....	...	+	...	...	...	+	+	+	...	...	...	...
Dictyota pinnatifida Kuetz. ....	...	+	+	...	...	+	+	+	...	...	...	...
Dictyota acuminata Kuetz. ....	...	...	+	+	...	+	+	+	...	...	...	...
Dilopus Fasciola (Roth) Howe ....	...	+	...	+	...	+	+	+	...	...	...	...
Cystophyllum muricatum (Turn.) J. Ag. ....	...	...	+	...	...	+	+	+	...	+	+	...
var. virgata (Endl. et. Diew) J. Ag. ....	...	...	...	...	...	+	+	+	...	...	...	...
Sargassum tenerrimum J. Ag. ....	...	...	...	...	...	+	+	+	...	...	...	...
Sargassum persicum kuetz. ....	...	...	...	...	...	+	+	+	...	...	...	...
Sargassum illicifolium (Turn.) C. Ag. ....	...	+	...	...	...	+	+	+	...	...	...	...
Sargassum cinereum J. Ag. ....	...	...	...	...	...	+	+	+	...	...	...	...
var. berberifolium Grum. ....	...	...	...	...	...	+	+	+	...	...	...	...
Sargassum plagiophyllum (Mert.) J. Ag. ....	...	...	...	...	...	+	+	+	...	...	...	...
Rhodophyceae												
Erythrotrichia carnea J. Ag. ....	...	+	+	+	...	+	+	+	...	...	...	...
Goniotrichum elegans (Chauv.) Le Jolis ....	...	+	+	+	...	+	+	+	...	+	+	+
Erythrocladia subintegra Rosenvingea ....	...	+	+	+	...	+	+	+	+	+	+	+
Acrochaetium crassipes Boergs. ....	...	+	+	...	...	+	+	+	...	...	...	...
Acrochaetium erectum Boergs. ....	...	+	+	...	...	+	+	+	...	...	...	...
Acrochaetium sargassicolum Boergs. ....	...	...	...	...	...	+	+	+	...	...	...	...
Acrochaetium cōwarkense Boergs. ....	...	...	...	...	...	+	+	+	...	...	...	...
Liagora ceranoides Lamour ....	...	...	...	...	...	+	+	+	...	...	...	...
Heliminthocladia australis Hary. ....	...	+	+	...	...	+	+	+	+	+	+	...
Chrysomenia Uvaria (L.) J. Ag. ....	...	...	...	...	...	+	+	+	...	...	...	...
Scinia Hatei Boergs. ....	...	+	+	+	...	+	+	+	...	...	...	...
Scinaia indica Boergs. ....	...	...	...	...	...	+	+	+	...	...	...	...
Scinaia furcellata J. Ag. ....	...	...	...	...	...	+	+	+	...	...	...	...
Gloeophlea fascicularis Boergs. ....	...	+	+	...	...	+	+	+	...	...	...	...
Golaxaura oblongata Lamour ....	...	...	...	...	...	+	+	+	...	...	...	...
Asparagopsis sandfordiana Harv. ....	...	+	+	+	...	+	+	+	...	...	...	...
Gelidium pusillum (Stackh) Le Jolis ....	...	+	+	+	...	+	+	+	+	+	+	+

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Name of species under each class of Algae	Atlantic Ocean		Indian Ocean				Pacific Ocean					
	West Indies, America	Europe, Africa	Mediterranean	Cape	Red Sea	India, Ceylon, Africa	Malayan Archiplg.	S. W. Australia	Japan	N. E. Australia	Polynesia	America
Geidium pulvinatum (Kutz.) Thur.	...	+				+						
f. parvissima Boergs.	...											
Gelidium heleroplator Boergs.	...					+						
Gelidium corneum (Huds.) Lamour	...	+	+	+	+	+	+	+	+	+	+	+
Gelidiopsis variabilis (Grev.) Schmitz	...	+	+			+	+		+	+		
Gelidiella myrioclada (Boergs.) Feldm. et Hamel	...					+						
Echinocaulon acerosum (Forsk.) Boergs.	...	+	+	+		+	+		+		+	
Gaulacanthus ustulatus (Mert.) Kuetz.	...		+	+	+	+	+					
Chondrococcus Hornemanil (Mert.) Schmitz.	...				+	+	+	+	+		+	+
Peyssonnelia obscura Web. v. Bosse	...					+						
var. bonabyensis Boergs.	...											
Crouiella bicolor Boergs.	...					+						
Hildenbrandia prototypus Nardo.	...	+	+	+	+	+	+	+	+	+	+	+
Amphiroa fragilissima (L.) Lamour	...	+	+	+		+	+		+		+	+
Amphiroa anceps (Lamour.) Decsue	...	+			+	+	+	+			+	+
Amphiroa dilatata Lamour	...				+				+	+	+	+
Cheilosporum spectabile Harv.	...					+	+				+	+
Corallina officitalis Linn.	...	+	+	+	+	+	+		+	+	+	+
Jania rubens (L.) Lamour	...	+	+	+	+	+	+		+	+	+	+
Grateloupia indica Boergs.	...					+	+		+	+	+	+
Grateloupia filicina (Wulf.) Ag.	...	+	+	+	+	+	+		+	+	+	+
Halymenia fastigiata J. Ag.	...			+		+						
Halymenia porphyroides Boergs.	...				+	+						
Halymenia polydactyla Boergs	...					+						
Halymenia venusta Boergs.	...					+						
Cryptonemia undulata Sond	...					+		+				
Cryptonemia Lomatium (Bertel.) J. Ag.	...		+	+		+	+	+	+			
Solieria robusta (Grev.) Kylin	...					+	+	+				
Sarconema scinaoides Boergs.	...					+						
Sarconema furcatum Boergs.	...					+						
Sarconema furcellatum Zanard	...					+						
Sarconema filiformis (Sond.) Kylin	...					+		+				
Sarconema miniata (Ag.) J. Ag.	...	+	+			+						
Meristotheca populosa (Mont.) J. Ag.	...					+	+		+		+	
Catenella repens (Lightf.) Batters	...	+	+	+		+					+	
Cystoclonium purpureum (Huds.) Batters	...	+	+			+						
Calliblepharis fimbriata Kutz.	...			+		+						
Hypnea Valentiae (Turn.) Mont.	...	+	+	+	+	+	+	+	+	+	+	+
Hypnea musciformis (Wulf.) Lamour	...	+	+	+	+	+	+	+	+	+	+	+
Hypnea specifera (Suhr.) Harv	...				+	+	+				+	+
Hypnea hamulosa J. Ag.	...	+			+	+	+				+	+
Plocamium coccineum (Huds.) Lyngb.	...	+	+	+	+	+	+	+	+	+	+	+
Plocamium 'elfairiae Harv.	...					+			+	+	+	
Sarcodia dichotoma Boergs	...					+						
Gracilaria foliefera (Forsk.) Boergs	...	+	+	+	+	+	+	+	+	+	+	+
Gracilaria corticata J. Ag.	...					+	+	+				
var. ramalinoides J. Ag.	...					+	+					

Name of species under each class of Algae	Atlantic Ocean				Indian Ocean				Pacific Ocean			
	West Indies, America	Europe, Africa	Mediterranean	Cape	Red Sea	India, Ceylon, Africa	Malayan Archipelg.	S. W. Australia	Japan	N. E. Australia	Polynesia	America
Gracilaria confervoides (L.) Grev.	...	+	+	+	+	+	+	+	+	+	+	+
Gracilaria arcuata Zanard	...	+	+	+	+	+	+	+	+	+	+	+
Corallopsis Cacalia J. Ag.	...	+	+	+	+	+	+	+	+	+	+	+
Gigartina acicularis (Wuld.) Lamour	...	+	+	+	+	+	+	+	+	+	+	+
Ahnfeltia plicata (Huds.) Fr.	...	+	+	+	+	+	+	+	+	+	+	+
Callymeria reniformis (Turn.) J. Ag.	...	+	+	+	+	+	+	+	+	+	+	+
Rhodymenia australis (Sond.) Harv.	...	+	+	+	+	+	+	+	+	+	+	+
Halichrysis? strafforellii (Ardiss.) De Toni	...	+	+	+	+	+	+	+	+	+	+	+
Botryocladia leptopoda (J. Ag.) Kylin	...	+	+	+	+	+	+	+	+	+	+	+
Dicranema? furcellatum (Mont.) J. Ag.	...	+	+	+	+	+	+	+	+	+	+	+
Coelarthrum Muelleri (Sond.) Boergs.	...	+	+	+	+	+	+	+	+	+	+	+
Champia compressa Harv.	...	+	+	+	+	+	+	+	+	+	+	+
Champia indica Boergs.	...	+	+	+	+	+	+	+	+	+	+	+
Champia somalensis Hauck	...	+	+	+	+	+	+	+	+	+	+	+
Champia parvula (Ag.) Harv.	...	+	+	+	+	+	+	+	+	+	+	+
Erythrocolonium Muelleri Sond	...	+	+	+	+	+	+	+	+	+	+	+
Ceramium rubrum (Huds.) Ag.	...	+	+	+	+	+	+	+	+	+	+	+
var. virgata Ag	...	+	+	+	+	+	+	+	+	+	+	+
Ceramium miniatum Suhr	...	+	+	+	+	+	+	+	+	+	+	+
Monospora indica Boergs.	...	+	+	+	+	+	+	+	+	+	+	+
Spyridia filamentosa (Wulf.) Harv.	...	+	+	+	+	+	+	+	+	+	+	+
Spyridia alternans Boergs.	...	+	+	+	+	+	+	+	+	+	+	+
Spyridia aculeata (Schimp.) Kuetz.	...	+	+	+	+	+	+	+	+	+	+	+
var. inermis Boergs.	...	+	+	+	+	+	+	+	+	+	+	+
Centroceras clavatum (Ag.) Mont.	...	+	+	+	+	+	+	+	+	+	+	+
Haloplegma Duperreyi Mont.	...	+	+	+	+	+	+	+	+	+	+	+
Griffithsia tenuis C. Ag.	...	+	+	+	+	+	+	+	+	+	+	+
Griffithsia flabelliformis Harv. (?)	...	+	+	+	+	+	+	+	+	+	+	+
Hypoglossum spathulatum (Kuetz. ?) J. Ag.	...	+	+	+	+	+	+	+	+	+	+	+
Membranoptera Murrayi Boergs.	...	+	+	+	+	+	+	+	+	+	+	+
Myriogramme okhanensis Boergs.	...	+	+	+	+	+	+	+	+	+	+	+
Caloglossa bombayensis Boergs.	...	+	+	+	+	+	+	+	+	+	+	+
Caloglossa Leprieurii (Mont.) J. Ag.	...	+	+	+	+	+	+	+	+	+	+	+
Nitophyllum punctatum (Stackh.) Grev.	...	+	+	+	+	+	+	+	+	+	+	+
Platysiphonia miniata (Ag.) Boergs.	...	+	+	+	+	+	+	+	+	+	+	+
Cottoniella fusiformis Boergs.	...	+	+	+	+	+	+	+	+	+	+	+
Claudea elegans Lamour	...	+	+	+	+	+	+	+	+	+	+	+
Laurencia papillosa (Forsk.) Grev.	...	+	+	+	+	+	+	+	+	+	+	+
Laurencia obtusa (Huds.) Lamour	...	+	+	+	+	+	+	+	+	+	+	+
var. divaricata (J. Ag.) Yam	...	+	+	+	+	+	+	+	+	+	+	+
var. majuscula Harv.	...	+	+	+	+	+	+	+	+	+	+	+
Laurencia cruciata Harv.	...	+	+	+	+	+	+	+	+	+	+	+
Laurencia pannosa Zand	...	+	+	+	+	+	+	+	+	+	+	+
Laurencia virgata J. Ag	...	+	+	+	+	+	+	+	+	+	+	+
Laurencia hypnoides Boergs.	...	+	+	+	+	+	+	+	+	+	+	+
Laurencia filiformis (Ag.) Mont	...	+	+	+	+	+	+	+	+	+	+	+
Laurencia platyclada Boergs.	...	+	+	+	+	+	+	+	+	+	+	+
Laurencia pedicularioides Boergs.	...	+	+	+	+	+	+	+	+	+	+	+

## A GENERAL REVIEW OF THE MARINE ALGAE

57

Name of species under each class of Algae	Atlantic Ocean			Indian Ocean			Pacific Ocean		
	West Indies, America	Europe, Africa	Mediterranean	Cape	Red Sea	India, Ceylon, Africa	Malayan, Archipelago	S. W. Australia	Japan
<i>Chondria dasyphylla</i> (Woodw.) Ag. ...	+	+	+		+	+	+	+	+
var. <i>stellata</i> Boergs. ...					+	+	+		
<i>Chondria cornuta</i> Boergs. ...					+	+	+		
<i>Chondria tenuissima</i> ...	+	+	+		+	+	+	+	+
<i>Acanthophora Delilei</i> Lamour ...			+		+	+	+		
<i>Acanthophora dendroideas</i> Harv. ...					+	+	+		
<i>Polysiphonia platycarpa</i> Boergs. ...					+	+	+		
<i>Polysiphonia variegata</i> (C. Ag.) Zanard ...	+	+			+	+	+		
<i>Polysiphonia ferulacea</i> Suhr ...	+	+	+		+	+	+		+
<i>Polysiphonia elongata</i> (Huds.) Harv. ...	+	+	+		+	+	+		
<i>Polysiphonia utricularis</i> Zanard ...					+	+			
<i>Polysiphonia corymbosa</i> J. Ag. ...					+	+	+		
<i>Roschera glomerulata</i> (C. Ag.) ...					+	+	+	+	+
<i>Lophocladia Lallemandi</i> (Mont.) Schmitz ...	+	+			+	+	+	+	
<i>Spirocladia Barodensis</i> Boergs. ...					+	+			
<i>Herposiphonia tenella</i> (Ag.) Naegl. ...	+	+	+		+	+			
<i>Leveillea jungermannioides</i> (Mart. et Her.) Harv. ...					+	+	+	+	+
<i>Heterosiphonia cloiphylla</i> (Ag.) Falkb. ...				+	+	+	+		
<i>Heterosiphonia Muellerei</i> (Sond.) DeToni ...					+	+	+		
<i>Heterosiphonia Wyrdemanni</i> (Baill.) Falkb ...					+	+			
f. <i>laxa</i> Boergs. ...	+	+	+		+	+			
<i>Dasya flagellifera</i> Boergs. ...					+	+	+		
<i>Falkenbergia rufolanosa</i> (Harv.) Schmitz ...					+	+	+	+	+

Systematic enumeration of unrecorded and little known species in James Murray's Collection of Sea-weeds from Karachi (Bombay Coast) in the Herbarium of the Royal Botanic Garden, Calcutta.

## CLASS—CHLOROPHYCEAE.

## FAMILY I. ULVACEAE.

1. *Ulva fasciata* Delile. forma typica. De Toni Syllg. Alg., Chlo., vol. i, pp. 114-15. (Plate I, fig. 1.)

Thallus green or slightly yellowish green, 25-30 cm. long and 22-25 cm. broad; fronds fasciated, shortly stalked at the base, rather cuneate; segments opposite, simple or dichotomous, long, linear or linear lanceolate, gradually attenuated towards the apices, sometimes divided upwards, irregularly tortuous, sinuate and sparsely toothed along the margin, apex acute or obtuse; cells of the frond more or less verticillate, elongate, somewhat less elongated when converging tangentially towards the margin, rounded or angular in surface view, about 10  $\mu$  in diameter, oblong or rectangular as seen in the cross section of the upper part of the frond but much narrowly rectangular, nearly oblong or linear

towards the base, about 16-20  $\mu$  long and 10  $\mu$  broad. Reported for the first time from the Bombay Coast.

*Habitat*.—Manora rocks, 'Kurachee', No. 11, Leg. J. A. Murray! 1881. Pl. I, fig. 1, 1/5 Nat. size.

This form of *Ulva fasciata* agrees well with the characters of the typical form of *U. fasciata*, forma typica, hence it has been accepted as such. It differs however in some points from the form described as *U. fasciata* by Anand in his 'Marine Algae from Karachi', Part I, Chlorophyceae, p. 16, 1940.

#### CLASS—RHODOPHYCEAE (FLORIDEAE).

##### FAMILY II. CHAETANGIACEAE.

2. *Scinaia furcellata* (Turn) Bivona. De Toni Syllg. Alg., Florideae, vol. i, pp. 104-5. (Plate I, fig. 2.)

Thallus fastigiate, one to many growing together, 5-25 cm. long and 10-15 cm. broad, brownish red or pale pink; fronds 2-15 cm. long, 1-2 mm. thick, cylindrical or sub-compressed, sometimes constricted at intervals, gelatinously membranaceous, somewhat tapering towards the base, repeatedly and regularly dichotomous and fastigiate; apices obtuse or occasionally prolonged to subacute ends. Fruits not seen. Reported for the first time from the Bombay Coast.

*Habitat*.—On rocks, 'Kurachee', No. 44, Leg. J. A. Murray! 1881. Pl. I, fig. 2, 1/7 Nat. size.

##### FAMILY III. DICRANEMACEAE.

3. *Dicranema furcellatum* (Mont.) J. Ag. De Toni Syllg. Alg., Florideae, vol. i, pp. 271-72. (Plate I, fig. 3.)

Thallus solitary or more than one, rather furcate upwards, 10-20 cm. long and 8-15 cm. broad; fronds 5.1 mm. thick, slender filiform, cartilaginous-gelatinous, sparsely dichotomously branched, more or less fastigiate, branches often erecto-patent. Fruits not seen. Reported for the first time from the Bombay Coast.

*Habitat*.—Attached to rocks, 'Kurachee', Nos. 53, 54, 55, Leg. J. A. Murray! 1881. Pl. I, fig. 3, 1/6 Nat. size.

##### FAMILY IV. CALLYMINIACEAE.

4. *Callymenia reniformis* (Turn.) J. Ag. De Toni Syllg. Alg., Florideae, vol. i, pp. 297-98. (Plate I, fig. 4.)

Thallus 5-8 cm. in diameter, pinkish or flesh coloured; fronds about 10 cm. wide, membranous, gelatinous, irregularly lobed, the base of the frond when mature conspicuously stalked, broadly obovate or often reniform, lobes obovate, irregularly split, cuneately expanded, margins somewhat smooth, entire or more less minutely proliferate, proliferations obovate, orbicular, subacute. Fruits not seen. Reported for the first time from the Bombay Coast.

*Habitat*.—Attached to rocks, 'Kurachee', No. 42, Leg. J. A. Murray! 1881. Pl. I, fig. 4, 1/5 Nat. size.

I confirm the determination and the name noted on the sheet. This form is more allied to the variety *Undulata* but it does not tally with this variety in all respects.

##### FAMILY V. RHODOMENIACEAE.

5. *Halichrysis depressa* Schousb. De Toni Syllg. Alg., Florideae, vol. ii, pp. 534-35. (Plate II, fig. 1.)

Thallus about 18 cm. long and 20 cm. broad, carnosae; fronds 3-8 mm. wide, membranaceous, even, more or less thick, widely expanded, irregularly lobed; lobes 2-5 mm. broad, oblong, dilated upwards, subpinnatifid upwards; fruits not seen. Reported for the first time from the Bombay Coast.

*Habitat*.—Attached to rocks, 'Kurachee', No. 48, Leg. J. A. Murray! 1881. Pl. II, fig. 1, 1/5 Nat. size.

This species is named *Chrysomenia depressa* Schousb. on the Herb. sheet. Examination of the actual specimens and literature proves that the specimen is a form of the species described above.

6. *Erythrocolon Muelleri* (Sond) J. Ag. De Toni Syllg. Alg., Florideae, vol. ii, p. 585. (Plate II, fig. 2.)  
Thallus 15-20 cm. long and 20-30 cm. broad, gelatinous, membranaceous, spreading, purplish red; fronds cylindrical, tubular, constricted at regular intervals, divided into long pyriform joints by internal diaphragms; secondary fronds, 10-16 cm. or more in length, fastigate, regularly di- or trichotomously-branched, constricted into joint-like internodes; internodes 10-20 mm. long, 5-6 mm. broad, oblong, rounded at the apices, slightly tapering towards the base, the upper internodes short and more rounded, and each internode is surmounted by generally 2 or sometimes 3-4 similar internodes which are separated by distinct stalk-like nodes or pedicels; pedicels 1-3 mm. long and 5-1 mm. broad, slender, cylindrical, scattered over the internodes as minute tubercles. Reported for the first time from the Bombay Coast.

*Habitat*.—On rocks, 'Kurachee', No. 50, Leg. J. A. Murray! 1881. Pl. II, fig. 6, 1/6 Nat. size.

*Chylocladia Muelleri* Sond. is a synonym.

#### FAMILY VI. DELESSERIAACEAE.

7. *Delesseria sinuosa* (Good, et Woodw.) Lamour. De Toni Syllg. Alg., Florideae, vol. ii, pp. 705-6. (Plate II, fig. 3.)

Thallus 6-10 cm. long and 5-20 mm. broad, elongate, sinuose, bright-red with widely separated fronds; fronds fasciated, leathery, ribbon-shaped, irregularly attenuated at the base, stipitate, stalk 1 mm. thick, dark red, midrib prominent, 5-1 mm. thick, reaching half or a little above but never reaching the apices of the fronds, lateral veins absent, margin irregularly lobed or somewhat proliferate. Reported for the first time from the Bombay Coast.

*Habitat*.—On rocks, 'Kurachee', No. 51, Leg. J. A. Murray! 1881. Pl. II, fig. 7, 1/6 Nat. size.

The specimen which was identified as *Delesseria subdichotoma* J. Ag., as noted on the Herb sheet, has been ascertained to be a form of *D. sinuosa* (Sond) J. Ag.

#### FAMILY VII. GRATELOUPIACEAE.

8. *Halymenia fastigiata* J. A. De Toni Syllg. Alg., Florideae, vol. iv, p. 1541. (Plate II, fig. 4.)

Thallus 5-16 cm. long and 6-10 cm. wide, fastigate, pink or dark pink; fronds 1-3 mm. broad, compressed, tubular, gelatinous, more or less loosely dichotomous, upper segments; sometimes spreading or furcate, attenuated towards the base, tapering acuminate into fine acute points, terminal segments often minutely proliferate. Reported for the first time from the Bombay Coast.

*Habitat*.—Attached to rocks, 'Kurachee', Nos. 56, 57, Leg. J. A. Murray! 1881. Pl. II, fig. 8, 1/5 Nat. size.

#### CLASS—PHAEOPHYCEAE (FUCOIDEAE).

#### FAMILY VIII. SARGASSACEAE.

9. *Sargassum persicum* Kuetz. De Toni Syllg. Alg., Fucoideae, p. 114. (Plate III, fig. 1.)

Thallus 15-25 cm. long and 4-15 cm. broad at the base, 10 mm. broad at the ends; primary branches of the frond 15-25 cm. long, narrow, more or less filiform, slender, terete, glabrous; secondary branches 1-8 cm. long, alternately arranged on either side of the primary branches and at a distance of about 1-3 cm. apart, these carry shorter tertiary branches in their turns; leaves variable, 2.5-4.5 cm. long, 5-19 mm. broad, marked with a distinct or slightly indistinct midrib, apex broadly or obtusely rounded, margins indistinctly denticulate or irregularly wavy, subsessile or stalked, pedicels 1-3 mm. long, .5 mm. thick; leaves of secondary branches smaller and those of tertiary still smaller and apices shortly obtuse; vesicles obovate, globose, 1-2 mm. diameter, borne on very short filiform stalk. Reported for the first time from the Bombay Coast.

*Habitat*.—On rocks, 'Kurachee', No. 49, Leg. J. A. Murray! 1881. Pl. III, fig. 9, 1/6 Nat. size.

## FAMILY IX. DICTYOTACEAE.

10. *Padina Fraseri* (Grev.) J. Ag. De Toni Syllg. Alg., Fucoideae, p. 246. (Plate III, fig. 2.)

Thallus 12-15 cm. long, 1-1.5 cm. broad, brown to dark brown in colour, cuneately lobed, attached to the substratum by subconcentric basal organ with hairy rhizoids covered with chalky powder; fronds 5-16 cm. long and 1-5 cm. broad at the fan-shaped apices, attenuated to 1 mm. to 5 mm. broad at the stalk-like bases, cuneate, membranous above at the broad rounded ends, somewhat subcoriaceous towards the narrowed bases, irregularly somewhat dichotomously branched by splitting up more or less deeply of the blades; lobes of the flabellated portions distinctly marked by narrow concentric bands of minute hair-like structures, 1-6 mm. apart, dark brown at the base and pale brown near the margin. Fruits not seen. Reported for the first time from the Bombay Coast.

*Habitat*.—On rocks, 'Kurachee', No. 40, Leg. J. A. Murray! 1881. Pl. III, fig. 10, 1/5 Nat. size.

11. *Stoechospermum maculatum* J. Ag. De Toni Syllg. Alg., Fucoideae, p. 252. (Plate III, fig. 3.)

Thallus 15 cm. long, 4 cm. broad above brown, elongate, more or less lanceolate attenuated below ending in a stalk-like base; fronds sub-fastigiate, decompositely dichotomously branched; segments lanceolate or linear-lanceolate flattened, tongue-shaped towards the apices. Fruits not seen. Reported for the first time from the Bombay Coast.

*Habitat*.—On rocks, 'Kurachee', No. 71, Leg. J. A. Murray! 1881. Pl. III, fig. 11, 1/5 Nat. size.

## FAMILY X. LAMINARIACEAE.

12. *Phyllaria reniformis* (Lamour) Rostaf. De Toni Syllg. Alg., Fucoideae, pp. 321-22. (Plate III, fig. 4.)

Thallus about 30 cm. long and 10 cm. broad, brown or greenish brown, ovate-oblong or reuniform, fastigiate, digitately expanded, ending in somewhat solid, flattened, roundish stalks; fronds about 30 cm. long, 2-10 mm. broad, ribbon-shaped, slightly attenuated towards the base, tapering to acuminate pointed ends, membranous, segments digitate, 10 mm. broad at widest middle portion. Fruits not seen. Reported for the first time from the Bombay Coast.

*Habitat*.—On rocks, 'Kurachee', No. 10, Leg. J. A. Murray! 1881. Pl. III, fig. 12, 1/8 Nat. size.

*Laminaria brevipes* Ag. is considered a synonym of the above specific name. The species described differ from the typical form in several characters. It is therefore rightly suggested, as noted on the Herbarium sheet, to be a variety of the above species. The variety, however, can only be established by further examination of the fruits which are absent in the specimen available.

## EXPLANATION OF FIGURES.

## PLATE I.

- Fig. 1.—*Ulva fasciata* Delile. 1/5 Nat. size.  
Fig. 2.—*Scinaia furcellata* (Turn.) Biv. 1/7 Nat. size.  
Fig. 3.—*Ditranea furcellatum* (Mont.) J. Ag. 1/6 Nat. size.  
Fig. 4.—*Callymenia reniformis* (Turn.) J. Ag.

## PLATE II.

- Fig. 5.—*Halichrysis depressa* Schousb. 1/5 Nat. size.  
Fig. 6.—*Erlthrocolon Muelleri* (Sond) J. Ag. 1/6 Nat. size.  
Fig. 7.—*Delesseria sinuosa* (Good, et Woodw.) Lamour. 1/6 Nat. size.  
Fig. 8.—*Halymenia fastigiata* J. Ag. 1/5 Nat. size.

## PLATE III.

- Fig. 9.—*Sargassum persicum* Kuetz. 1/6 Nat. size.  
Fig. 10.—*Padina Fraseri* (Grev.) J. Ag. 1/5 Nat. size.  
Fig. 11.—*Stoechospermum maculatum* J. Ag. 1/5 Nat. size.  
Fig. 12.—*Phyllaria reniformis* (Lamour) Rostaf. 1/8 Nat. size.

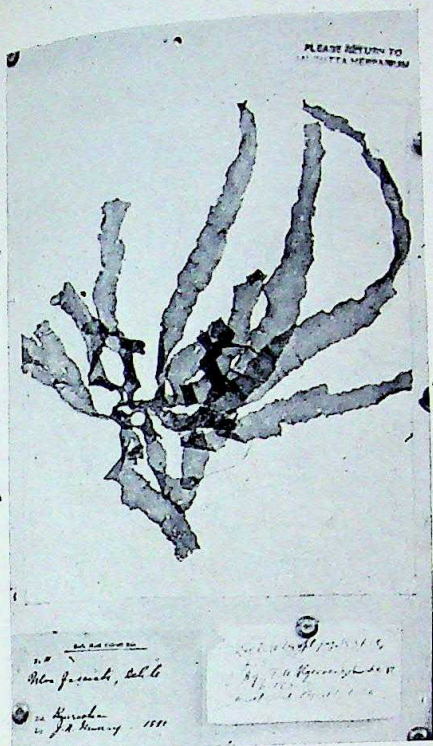


Fig. 1.—*Ulva fasciata*, Delile.

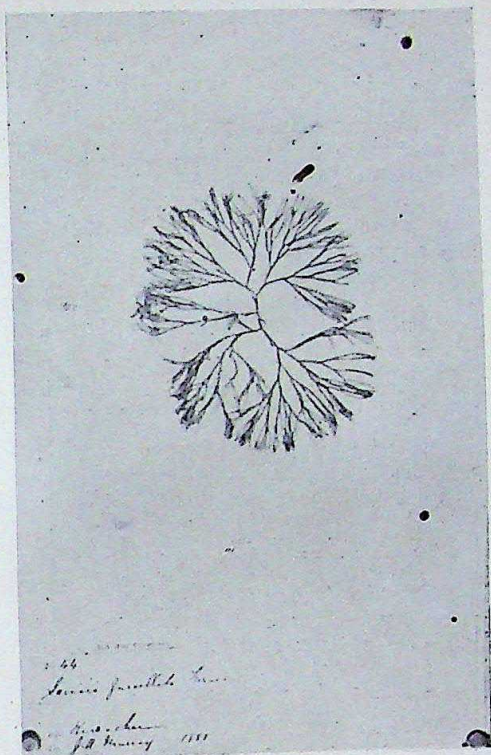


Fig. 2.—*Scinaia furcellata* (Turn.) Biv.

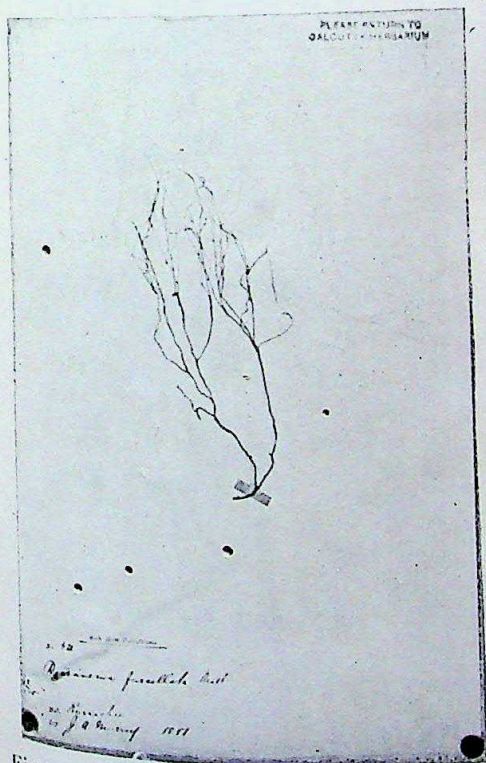


Fig. 3.—*Diclranema furcellatum* (Mont.) J. Ag.



Fig. 4.—*Callymenia reniformis* (Turn.) J. Ag.

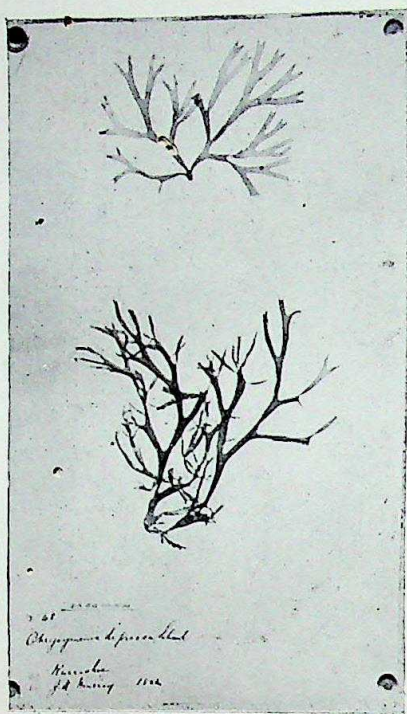


Fig. 5.—*Halichrysis depressa*, Schousb.

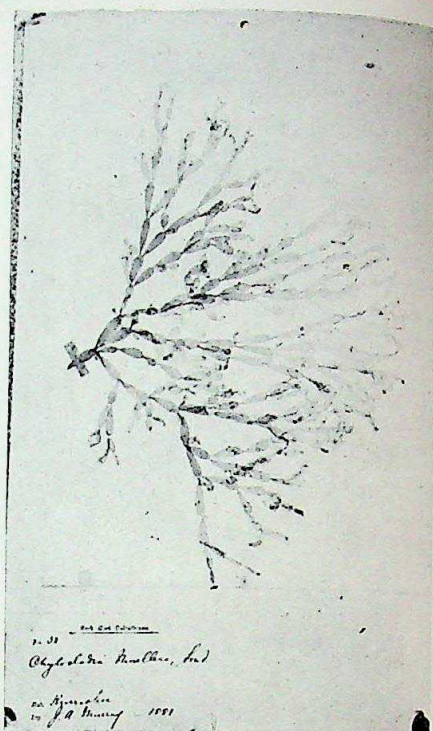


Fig. 6.—*Erthrocolon Muelleri* (Sond) J. Ag.



Fig. 7.—*Delesseria sinuosa* (Good, et Woodw.) Lamour.

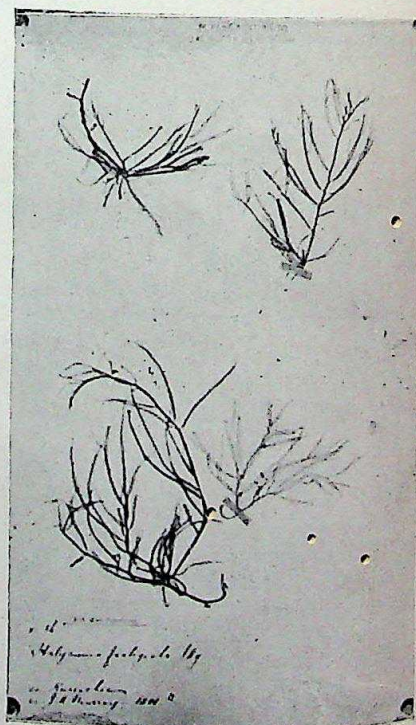


Fig. 8.—*Halymenia fastigiata*, J. Ag.

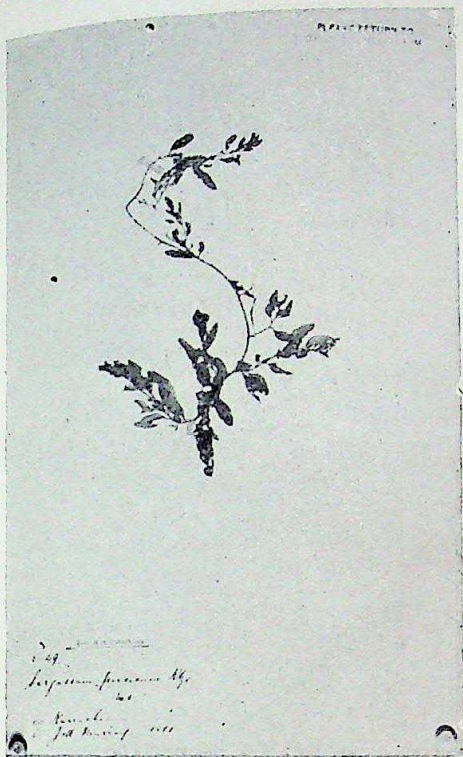


Fig. 9.—*Sargassum persicum*, Kuetz.



Fig. 10.—*Padina Fraseri* (Grev.) J. Ag.



Fig. 11.—*Stoechospermum maculatum* J. Ag.

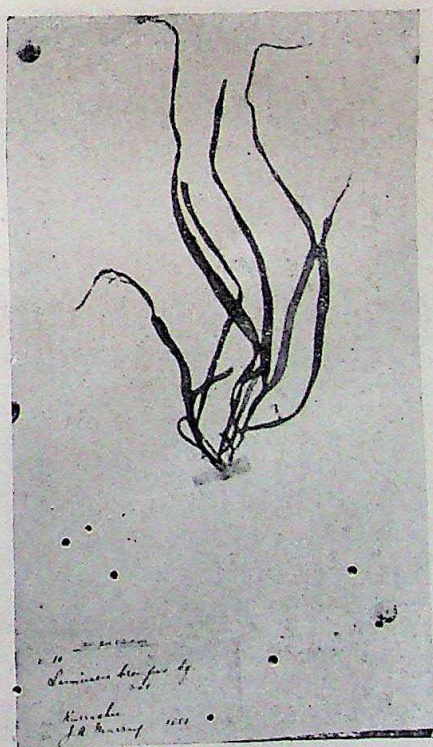


Fig. 12.—*Phyllaria reniformis* (Lamour) Rostaf.



# BIRDS ON THE HINDUSTAN-TIBET ROAD, N.-W. HIMALAYA.

BY

H. W. WAITE, C.I.E., M.B.O.U.

(With 2 plates)

Stoliczka's 'Ornithological observations in the Sutlej Valley, N.-W. Himalaya' appeared in the *Journal of the Asiatic Society of Bengal* (Vol. xxxvii, Part ii) in 1868 and so far as I am aware no similar observations in that area have been published since. The following list of birds seen during a trek along the Hindustan-Tibet Road in April-June 1941 may therefore be of interest.

I left Simla on April 10, reached Namgia (10 miles from Shipki and 2 miles from the Tibetan frontier) on May 24 and returned to Simla on June 27. In the itinerary given below the figures in brackets denote the road mileage from Simla and the dates in italics are those of the return journey.

Simla, 7,000'.	
Kufri, 8,270' (9)	10-11 April.
Fagu, 8,200' (12)	26 June.
Theog, 7,500' (18)	12-13 April.
Matiana, 7,430' (29)	14-15 April, 25 June.
Narkanda, 9,130' (40)	16-17 April, 24 June.
Bagi, 8,830' (49)	21-23 June.
Sungri, 8,850' (66)	18-20 June.
Bahli, 8,100' (77)	16-17 June.
Takleeh, 5,460' (87)	15 June.
Daranghati, 9,240' (98)	13-14 June.
Sarahan, 6,875' (89)	20-29 April, 11-12 June.
Chaura, 6,650' (98)	10 June.
Taranda, 7,000' (104)	30 April-2 May.
Paunda, 6,300' (108)	
Nachar, 7,090' (112)	3-5 May, 7-9 June.
Wangtu, 5,390' (116)	
Urni, 7,300' (124)	6-7 May, 6 June.
Rogi, 8,970' (136)	
Chini, 9,265' (140)	8-11 and 14-17 May, 31 May-5 June.
Pangi, 8,520' (144)	12-13 and 18 May, 30 May.
Jangi, 8,980' (159)	19 May, 29 May.
Kanam, 9,200' (172)	20-21 May, 27-28 May.
Poo, 8,400' (187)	22-23 May, 26 May.
Namgia, 9,750' (194)	24-25 May.

Beyond Narkanda the road descends to the bank of the Sutlej at Nirth and thence continues along the south side of the valley to Wangtu. Between Narkanda and Thanedar a high-level branch takes off and runs along the north side of the Hathu range to Bagi and Bahli. From there it descends to Takleeh and then climbs to Daranghati, whence it drops to rejoin the main road about two miles short of Sarahan. At Wangtu the road crosses to the right bank of the river and runs high above it to Kanam. From Kanam it drops to cross to the left bank again between Poo and Namgia and so on to Shipki.

The physiography of the Sutlej Valley is thus described by Stoliczka:—

'Proceeding westwards from the Kanawar frontier, near Shipki, we find that the Sutlej has forced its passage through the principal N.-W. Himalayan chain, cutting its bed to a depth of several thousand feet. Former terraces and old gravel beds of the river (and also of its tributaries) are seen, three and four thousand feet above the present level, which descends from about 8,000' at Shipki to 3,000' below Kotegarh. Within this entire length (amounting to about 160 miles) from Shipki to Suni (north of Simla) the Sutlej flows in a narrow channel between perpendicular cliffs of gneiss, the width of which seldom exceeds a few hundred feet. The Wanga and Baspa rivers, both of which are situated within the branches of the Central Himalayan chain, are the only large tributaries on the Indian slopes. (The longest tributary is the Spiti river: its valley has in general rather a Tibetan climate and a corresponding fauna and flora.)

The highest peaks in the Central chain rise on an average somewhat over 22,000' and the limit of snow lies in general at about 17,000', increasing to about 18,500' on the Tibetan slopes.

In the Sutlej valley itself only the higher terraces, situated between 6,000' and 9,000' are generally sufficiently large to afford room for cultivation and settlement, the slopes of the mountains being mostly precipitous. The width of the valley is even at these higher elevations merely a few miles. On the whole its physical conditions are not particularly favourable to agriculture, nor is there much room for a large population. . . . Viewing the general physical construction of the valley within the Central chain of the N.-W. Himalaya the greatest peculiarity consists in its small width, while the neighbouring hills rise to a very considerable elevation, and thus exhibit very different conditions of climate within a comparatively small geographical area.'

As regards rainfall, there is a moist zone in the lower 30 miles of the valley up to Wangtu, a dry zone in the next 20 miles and an arid zone in the upper 30 miles to the Tibetan frontier, where the monsoon nearly peters out. The figures of rainfall of Kotagarh (moist zone) and Kilba (near Urni, dry zone) are:—

	Dec.-Feb.	Mar.-May	June-Sept.	Oct.-Nov.	Total
Kotegarh	5.80	9.38	28.04	1.38	44.56
Kilba	8.63	11.18	10.68	1.92	32.41

Forest ceases at about Kanam, and beyond that the mountain sides are mostly bare.

Owing to the great depth and narrow width of the valley to cover any appreciable amount of ground entails strenuous climbing. Unfortunately ill-health severely curtailed my activities, and but for the efforts of my shikari, Lala Sheikh, the following list would have been even shorter than it is.

In the cases of birds marked with an asterisk specimens were obtained and these were identified by the late Hugh Whistler, to whom, and to Mr. A. E. Jones, I am indebted for much valuable advice and assistance.

For the convenience of those to whom old volumes of the J.A.S.B., are not readily available I have added Stoliczka's remarks, including those on species which were not observed.

\**Corvus macrorhynchos intermedius* Adams. Himalayan Jungle Crow.

Common throughout the valley and observed right up to the Tibetan frontier.

\**Urocissa erythrorhyncha occipitalis* (Blyth). Red-billed Blue Magpie.

Frequently met with as far as Taranda. Not seen beyond that nor lower than about 7,000'.

\* The Spiti river joins the Sutlej a little below Namgia.

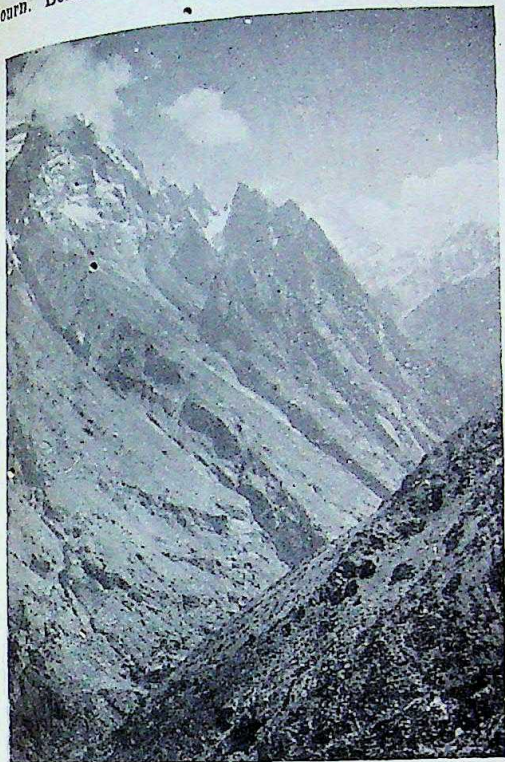


Fig. 1.—Between Namgia and Shipki.

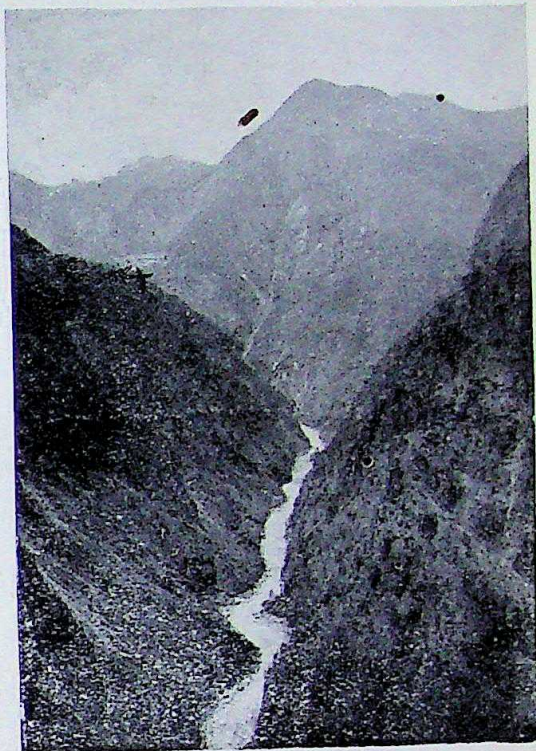


Fig. 2.—The Sutlej between Taranda and Chaura.

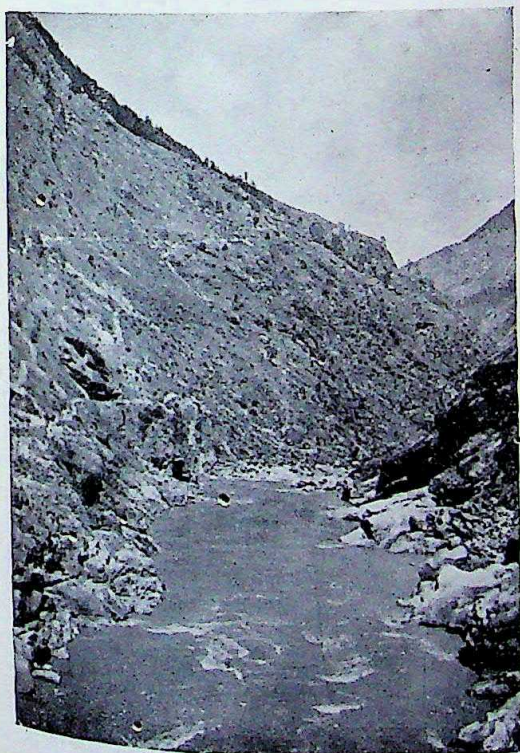


Fig. 3.—The Sutlej at Wangtu.

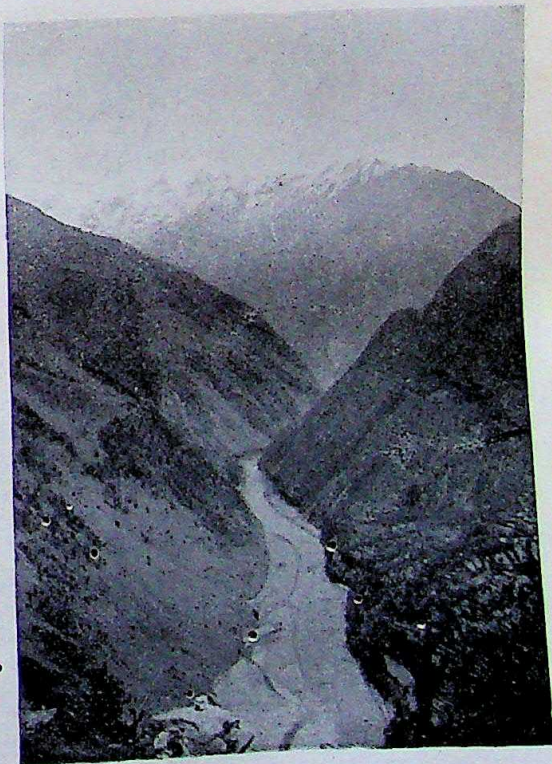


Fig. 4.—The Sutlej between Urni and Rogi.

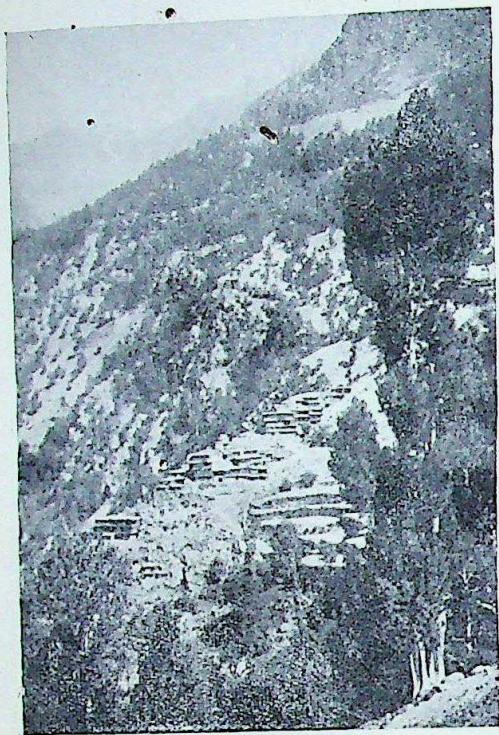


Fig. 5.—Pangi Village.

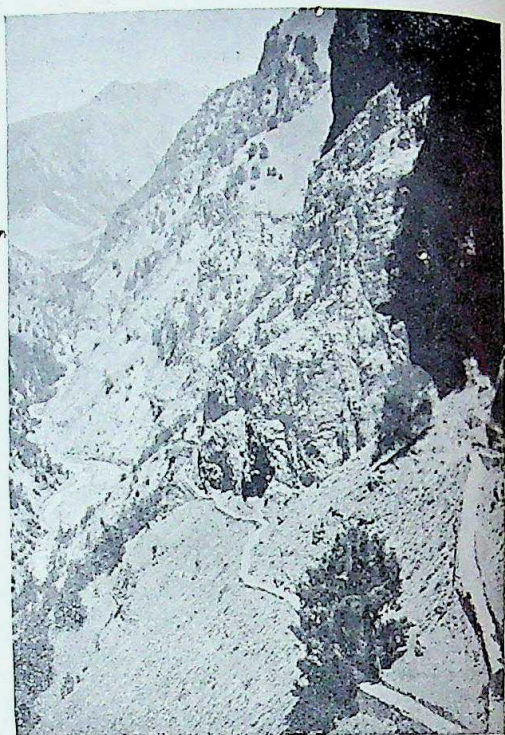


Fig. 6.—The Road in the Lipi Valley between Jangi and Kanam.

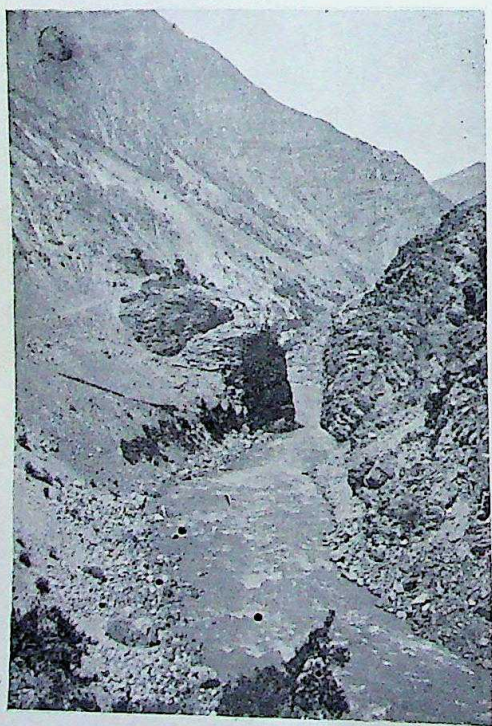


Fig. 7.—The Bridge over the Sutlej between Poo and Namgia.



Fig. 8.—The Sutlej between Poo and Kanam.

## BIRDS ON THE HINDUSTAN-TIBET ROAD

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*Dendrocitta vagabunda* Lath. Tree-pie.

Seen between Nirth and Rampur.

\**Garrulus lanceolatus* Vigors. Black-throated Jay.

Observed as far as Taranda but not beyond that nor below about 7,000'.

\**Nucifraga caryocatactes hemispila* Vigors. Himalayan Nut-cracker.

Frequently seen between Fagu and Sungri but not further east. Stoliczka noted that it was common from Simla to Chini.

\**Pyrrhocorax pyrrhocorax himalayanus* (Gould). Red-billed Chough.

First seen between Pangri and Jangi and commonly thence to Namgia. Stoliczka noted it as rare in summer round Chini.

\**Parus major caschmiriensis* Hart. Kashmir Grey Tit.

Only observed at comparatively low elevations in the neighbourhood of Rampur, Gaura and Taklech.

\**Parus monticolus monticolus* Vigors. Green-backed Tit.

Commonly met with as far as Pangri, but not below 7,000'. One was seen carrying moss to a hole in a bank at Kufri on April 10, and a pair was feeding young in a hole in the wall of Daranghati Rest House on June 13.

\**Lophophanes melanolophus* (Vigors). Crested Black Tit.

Common as far as Chini, but not seen below 7,000'. One was collecting moss at Narkanda on April 17, and a nest with 4 eggs was found above Chini on May 10.

\**Lophophanes rufonuchalis rufonuchalis* (Blyth). Simla Black Tit.

Observed about Chini and Kanam and also at Bagi, where it appeared to be fairly common.

\**Lophophanes dichrous kangrae*. Whistler. Brown-crested Tit.

A male with organs in breeding condition was obtained above Taranda on May 2. Occasionally seen at Sungri and Bagi. Not mentioned by Stoliczka.

[*Syiviparus modestus* Burton. Yellow-browed Tit.

Stoliczka recorded that this species was 'in summer common on the apricot trees about Pangri and Chini'. Although specially looked for at both of these places it was not observed.]

*Macholophus xanthogenys* (Vigors). Yellow-cheeked Tit.

Only seen in the neighbourhood of Bahli and Sungri.

\**Aegithaliscus concinnus iredalei* Stuart Baker. Red-headed Tit.

Met with from Sarahan to Nachar and also at Thanedar, Bahli and Sungri.

\**Sitta leucopsis leucopsis* Gould. White-cheeked Nuthatch.

This Nuthatch is still, as Stoliczka recorded, tolerably common in the neighbourhood of Chini. It was also obtained at about 9,000' between Sungri and Bagi.

\**Garrulax albogularis whistleri* Stuart Baker. Western White-throated Laughing Thrush.

Several were seen singly above Thanedar.

\**Trochaloxyron variegatum variegatum* (Vigors). Eastern Variegated Laughing Thrush.

Noted as common from Thanedar to Nachar, but not seen beyond that. Also observed about Daranghati, Sungri and Bagi. Two nests containing two and four eggs respectively were found at Rampur on April 24. According to

Stoliczka it occurs 'through the entire extent of the Sutlej valley up to Sungnum' (Sungnum is on the branch road which takes off between Kanam and Poo and goes to Dhankar in Spiti).

[*Pomatorhinus erythrogenys* Vigors. Vigor's Rusty-cheeked Scimitar-Babbler. Stoliczka recorded that this species was 'not common in the forests and thick brushwoods between Kotegarh and Nichar'.]

\**Stachyridopsis pyrrhops* (Blyth). Red-billed Babbler.

Only met with at Taklech, where a nest with one addled and two hard-set eggs was found on June 16. The nest was on the ground in a small bamboo clump on the edge of a brook. It was a compact structure of bamboo leaves and grass, and the fairly substantial foundation was completely sodden.

[*Fulvetta vinipecta* (Hodgs.). Hodgson's Fulvetta.

Recorded by Stoliczka from Matiana. Mr. A. E. Jones obtained it at Narkanda (J.B.N.H.S., xxvi, 604).]

\**Leioptila capistrata pallida* Hart. Pale Sibia.

A pair was seen near Sarahan in April and another in the same place in June.

\**Siva strigula strigula* Hodgs. Stripe-throated Siva.

A pair was obtained at Sarahan in April and a male at Bagi in June. Stoliczka says 'that this species 'in summer frequents thick forests, between 6,000 to 9,000' all along the elevated range from Simla to Nachar'.

\**Ixulus flavicollis albicollis* Ticehurst and Whistler. Yellow-headed Ixulus. A male was secured at Bahli, the only one seen.

[*Pteruthius erythropterus* (Vigors). Red-winged Shrike-Babbler.

Stoliczka says 'as far east as Nichar. Seen at Sarahan between 9,000 and 10,000'. Rare.]

\**Microscelis psaroides psaroides* (Vigors). Himalayan Black Bulbul.

Commonly seen as far as Pangi. Stoliczka found it 'common in the forests between Kotegarh and Nachar'.

*Molpastes leucogenys leucogenys* (Gray). White-cheeked Bulbul.

Not observed beyond Sarahan, but common as far as that. According to Stoliczka it is occasionally to be seen as far east as Chini.

\**Certhia himalayana himalayana* (Vigors). Himalayan Tree-creeper.

Met with from Narkanda to Bahli and also about Rogi and Chini.

\**Troglodytes troglodytes neglectus* (Brooks). Kashmir Wren.

Fairly common about Chini and also seen at Nachar. Young birds were seen at Chini on June 3.

[*Pnoepyga albiventer* (Gould). Scaly-breasted Wren.

Stoliczka says 'very rare in the forests about Nachar and Chini; it is found about Kotegarh in winter'.]

\**Cinclus pallasi tenuirostris* Bonaparte. Indian Brown Dipper.

Seen on streams about Chini and Pangi.

*Saxicola caprata bicolor* Sykes. Pied Bush-Chat.

Only seen in the neighbourhood of Nirth and Rampur. Stoliczka found it 'common all through the Sutlej valley up to Nachar'.

\**Saxicola torquata indica* Blyth. Indian Bush-Chat.

Common as far as Chini; also observed between Pangi and Jangi. A nest with four eggs was found, at about 10,000' above Chini on May 15.

- \*Oreicola ferrea ferrea** (Gray). Dark-grey Bush-Chat.  
Commonly seen as far as Chini, where Stoliczka says it breeds. A nest with three eggs was found at Gaura on April 27.
- \*Oenanthe pleschanka pleschanka** (Lepschin) Pied Chat.  
Not uncommon on the bare hillsides about Kanam and Poo. Not mentioned by Stoliczka.
- \*Enicurus maculatus maculatus** Vigors. Western Spotted Forktail.  
Seen about Nirth and Gaura and at Taklech.
- \*Phoenicurus frontalis** (Vigors). Blue-fronted Redstart.  
Met with at Chini and Pangl and high above Nachar. Not mentioned by Stoliczka.
- Phoenicurus ochruros** (Gmel.). Black Redstart.  
A few were seen across the Tibetan frontier between Namgia and Shipki on May 25; they were extremely wild.
- Chaimarrhornis leucocephala** (Vigors). White-capped Redstart.  
Observed between Sarahan and Taranda.
- Rhyacornis fuliginosa** (Vigors). Plumbeous Redstart.  
Frequently seen from Wangtu onwards as far as Kanam.
- \*Calliope pectoralis pectoralis** Gould. Himalayan Rubythroat.  
A fair number seen, amongst boulders and scrub, above Chini in May and June. There was a marked preponderance of males.
- \*Tarsiger chrysaeus whistleri** Ticehurst. Golden Bush-Robin.  
The male of a pair was secured above Nachar on May 5. Stoliczka noted that he had never met this species on his summer visits to the Sutlej valley.
- \*Lanthia cyanura pallidior** Stuart Baker. Kashmir Red-flanked Bush-Robin.  
Observed at Nachar and Chini. One was also obtained above Taranda on May 2 and a juvenile at Bagi on June 22. Stoliczka says 'this species does not occur in summer to the west of Nachar and not below 8,000'. It breeds near Chini.'
- \*Adelura coeruleocephala** (Vigors). Blue-headed Robin.  
Frequently seen from Urni to Pangl. Stoliczka says 'occurs plentifully beyond Pangl and about Chini, generally on small streams; it also breeds here'.
- \*Turdus merula maximus** (Seeborn). Central Asian Blackbird.  
A pair, the only ones seen, was obtained above Chini on June 1. It is not mentioned by Stoliczka, and this appears to be an extension of its known range.
- \*Turdus merula albocinctus** Royle. White-collared Ouzel.  
Several were observed singly near Narkanda in April and a pair at Daran-ghati in June.
- \*Arceuthornis viscivorus bonapartei** (Verr.). Missel Thrush.  
A pair was obtained from a flock near Narkanda in April. Also seen between Bagi and Narkanda in June. According to Stoliczka it breeds about Chini.
- \*Oreocincla dauma dauma** (Lath.). Small-billed Mountain-Thrush.  
A juvenile male was obtained on Mount HATHU, between Narkanda and Bagi on June 24. (Two other juvenile thrushes were secured at Sungri and Bagi but it could not be determined with certainty to which species they belonged.)

\**Monticola rufiventris* (Jard. and Selby). Chestnut-bellied Rock-Thrush.

Met with in the neighbourhood of Sungri. Stoliczka says 'only found in the lower hills about Simla and Kotegarh'.

\**Monticola cinclorhyncha* (Vigors). Blue-headed Rock-Thrush.

Several were observed at Taranda and Nachar, and it was also seen at Pangi. Stoliczka found it 'common about Sarahan and Nachar but rare at Chini'.

\**Myophonus temminckii temminckii* (Vigors). Himalayan Whistling-Thrush.

Common all the way from Simla to Namgia. Stoliczka noted that it bred at Chini and Sungnum.

\**Prunella strophliata jerdoni* (Brooks). Jerdon's Accentor.

An adult male and a juvenile were secured above Chini at the beginning of June. Stoliczka says 'occasionally comes in winter to Kotegarh and to other Himalayan parts of the Sutlej valley'.

\**Hemichelidon sibirica gulmergi* Stuart Baker. Kashmir Sooty Flycatcher.

Only seen at Nachar. Stoliczka says 'very common between 4,000 and 11,000', at which elevations I have often found it in the neighbourhood of Chini'.

\**Siphia strophliata euphonia* Koelz. Orange-gorgetted Flycatcher.

Obtained at Narkanda in April and Sungri in June. Stoliczka noted that it only came in winter to Kotegarh and even then was rather rare.

\**Cyornis superciliaris superciliaris* (Jerd.). White-browed Blue Flycatcher.

Stoliczka's remark that this is one of the most common birds in the Sutlej valley and is seen all the way to Pangi still holds good. A nest with four eggs was found at Urni on May 7.

*Eumylas thalassina* (Swains). Verditer Flycatcher.

Frequently seen as far as Taranda. Stoliczka noted that it did not go eastwards of the Nachar forests.

\**Alseonax ruficaudatus* (Swains.). Rufous-tailed Flycatcher.

Only seen at Urni, where a pair was obtained in May. Stoliczka found it 'abundant among apricot trees near Chini and Pangi'.

\**Culicicapa ceylonensis pallidior* Ticehurst. Simla Grey-headed Flycatcher.

Met with from Taranda to Nachar and was common at Taklech.

\**Tchitrea paradisi leucogaster* (Swains.). Himalayan Paradise Flycatcher.

Only seen at Rampur and Taklech. Stoliczka says 'rather rare in eastern portions of the Sutlej valley; I have never seen it much beyond the Nachar forests and above elevations of 9,000'.

\**Lanius shach erythronotus* (Vigors). Rufous-backed Shrike.

Observed at Rampur and Gaura and was not uncommon about Sarahan and Chini. Whistler noted on four specimens collected that they were intermediate with *tephronotus* but closer to *erythronotus*.

[*Lanius isabellinus* H. and E. Isabelline Shrike.

Stoliczka noted that he once met with this shrike east of Chini.]

\**Pericrocotus brevirostris brevirostris* (Vigors). Short-billed Minivet.

Common as far as Pangi but not seen below 7,000'.

\**Dicrurus longicaudatus* Hay. Indian Grey Drongo.

Common from Matiana to Sarahan and observed as far as Urni.

\**Sylvia althaea* Hume. Hume's Lesser Whitethroat.

A male was obtained at Urni on May 7 and another near Kanam on May 29. Stoliczka does not mention any Whitethroat.

\**Phylloscopus affinis* (Tick.). Tickell's Willow-Warbler.

One was obtained at Chini on May 9.

\**Phylloscopus trochiloides nitidus* (Blyth). \*Green Willow-Warbler.

Met with at Thanedar and between Nirth and Rampur.

\**Phylloscopus trochiloides ludlowi* Whistler. Dull Green Willow-Warbler.

A female was shot from a nest above Nachar, at about 10,000', on June 8. The nest, a loosely made domed structure of grass without any moss, and lined with a few Monal feathers, was on the ground amongst birch saplings and contained four fresh eggs. A fifth egg was about to be laid.

\**Phylloscopus occipitalis occipitalis* (Blyth). Large-crowned Willow-Warbler.

Obtained at Fagu, Chini and Namgia. A male shot at Namgia was evidently breeding.

*Seicercus xanthoschistos* (Gray). Grey-headed Flycatcher Warbler.

Seen at Taranda in May.

\**Horornis pallidus* (Brooks). Pale Bush-Warbler.

Common, and calling freely, round about Sungri; also met with near Narkanda in June.

\**Suya crinigera crinigera* Hodgs. Brown Hill-Warbler.

Common about Rampur, Sarahan and Taranda; also observed at river level between Wangtu and Urni. Stoliczka noted that it did not go very far into the interior.

\**Cephalopyrus flammiceps flammiceps* Burton. Fire-capped Tit-Warbler.

A male obtained at Gaura was the only one seen.

*Oriolus oriolus kundoo* Sykes. Golden Oriole.

Seen at Rampur and heard at Sarahan and Chini.

Stoliczka remarked that it was occasionally seen between Kotegarh and Rampur.

*Acridotheres tristis tristis* (L.). Common Mynah.

Observed as far as Sarahan, where it appeared to be common.

\**Perissospiza icteroides* (Vigors). Black-and-yellow Grosbeak.

Met with in parties about Narkanda in April; also found at Gaura and Nachar. At Narkanda one was seen foraging on a garbage heap by the side of the road.

\**Mycerobas melanoxanthus* (Hodgs.). Spotted-winged Grosbeak.

In June a few were seen near Sarahan and in the forests between that place and Daranghati. Not mentioned by Stoliczka.

\**Pyrrhula erythrocephala* (Vigors). Red-headed Bullfinch.

Seen above Nachar and Chini in May. Stoliczka noted that it bred about Kotegarh between 6,000 and 8,000'.

[*Loxia curvirostra himalayana* Blyth. Himalayan Crossbill.

Stoliczka noted that the Crossbill was 'only to be found in the forests about Chini and towards the east'.]

\**Carpodacus pulcherrimus pulcherrimus* (Moore). Beautiful Rose Finch.  
Found in fair numbers above Chini in May and June; also obtained above Nachar in June. Not mentioned by Stoliczka.

\**Carpodacus rhodochlamys grandis* Blyth. Red-mantled Rose Finch.  
Sparingly met with above Chini, between Jangi and Kanam and about Namgia.

\**Carpodacus rhodochroa* (Vigors). Pink-browed Rose Finch.  
Not uncommon at about 10,000' above Nachar, Chini and Pangi both in May and June.

\**Carpodacus erythrurus roseatus* (Hodgs.). Common Rose Finch.  
Seen commonly at Rampur, between Wangtu and Urni and at Chini and Pangi in May.

\**Callacanthis burtoni* (Gould). Red-browed Finch.  
Two pairs were obtained, and a few others seen, at Chini in June.

\**Serinus pusillus* (Pall.). Gold-fronted Finch.  
Numerous flocks proceeding up the valley were observed almost daily all the way from Rampur to Namgia. The last were seen between Jangi and Pangi on May 30.

\**Hypacanthus spinoides* (Vigors). Himalayan Green Finch.  
First met with about Chini in June. Later it was seen frequently from Daranghati to Matiana.

\**Oymnorhis xanthocollis* (Burton). Yellow-throated Sparrow.  
Seen at Nirth and Rampur.

\**Passer domesticus indicus* Jard. and Selby. Indian House-Sparrow.  
Noted at Rampur, Gaura, Sarahan and Poo.

\**Passer rutilans cinnamomeus* (Gould). Cinnamon Tree-Sparrow.  
Observed at Gaura, Taranda and Chini and between Taklech and Bahli.

\**Fringilla nemoricola altaica* (Eversm.). Stoliczka's Mountain-Finch.  
Met with in flocks above Chini in the second week of May and also obtained above Kanam in the last week of that month.

\**Emberiza fucata arcuata* Sharpe. Indian Grey-headed Bunting.  
A few were seen between Narkanda and Matiana in June.

\**Emberiza stewarti* Blyth. White-capped Bunting.  
Common from Nachar to Poo. On the return journey it was seen frequently from Sarahan to Bagi. Stoliczka says, 'In the Sutlej valley it is scarcely seen west of Wangtu bridge, but is very common about Chini and further to east. . . I found young birds about the middle of June.'

\**Emberiza cia stracheyi* Moore. Eastern Meadow-Bunting.  
Common in April about Fagu and Theog.

\**Melophus lathami subcristata* (Sykes). Crested Bunting.  
Only seen at Nirth.

\**Krimnocheilus rupestris* (Scop.). Crag Martin.  
Occasionally seen from Wangtu to Namgia.

**\*Hirundo daurica nepalensis** Hodgs. Hodgson's. Striated Swallow.

Observed on the outward journey at Matiana, where a pair was completing a nest on April 15, and from Thanedar to Sarahan. On return noted at Pangi and from Daranghati to Fagu.

**Motacilla alba personata** Gould. Masked Wagtail.

A few seen along the river from Nirth to Rampur.

**\*Motacilla alba alboides** Hodgs. Hodgson's Wagtail.

A few observed on river-side shingle between Kanam and Poo, and a male obtained had its organs in breeding condition. One was also seen in the Hub-sang Khad which marks the Tibetan boundary two miles beyond Namgia.

**Motacilla cinerea caspica** (Gmel.). Eastern Grey Wagtail.

One was seen on the road at Narkanda on April 17.

**\*Anthus trivialis haringtoni** Witherby. Witherby's Tree-Pipit.

One was obtained above Nirth.

**\*Anthus hodgsoni berezowskii** Sarudny. Kansu Tree Pipit.

A female was shot from a nest with four eggs in a forest clearing above Taranda at about 9,000' on May 1. Another was obtained a few days later above Nachar.

**\*Anthus similis jerdoni** (Finsch). Brown Rock Pipit.

Only seen above Nirth.

**\*Anthus roseatus** Hodgs. Hodgson's Pipit.

Met with in May above Nachar and Chini at about 10,000'.

**\*Oreocorys sylvanus** (Hodgs.). Upland Pipit.

Seen and heard commonly in suitable localities between 4,000 and 8,000' as far as Wangtu.

**Zosterops palpebrosa** (Temm. and Schlegel). White-eye.

Noted at Gaura and Nachar. Stoliczka found it breeding above Chini and says 'it is very common all through the valley as far as any rich arboreal vegetation exists'.

**[Æthopyga gouldiae** Vigors. Mrs. Gould's Yellow-backed Sunbird.

Stoliczka says 'very common at Kotegarh and through the whole valley as far east as Chini, living here at an elevation of between 9,000 and 10,000'.

**Cinnyris asiatica** (Lath.). Purple Sunbird.

Only seen between Nirth and Rampur. According to Stoliczka it occurs as far east as Wangtu.

**\*Picus squamatus squamatus** Vigors. Scaly-breasted Green Woodpecker.

Frequently seen as far as Taranda. Stoliczka noted that it was common all through the forests up to Chini and ascended to elevations of nearly 11,000'.

**\*Dryobates himalayensis himalayensis** (Jard. and Selby). Western Himalayan Pied Woodpecker.

Commonly met with as far as Kanam, where a pair was seen feeding young on May 20. A nest, with entrance 6 ft. from the ground, in the trunk of an apricot tree a few yards from the Rest House at Pangi contained three-fledged young on May 30. Stoliczka says 'common in the cedar and fir forests all through the valley as far east as Chini'.

**\*Dryobates auriceps** (Vigors). Brown-fronted Pied Woodpecker.

Not seen beyond Thanedar. Stoliczka says 'I have not seen it to the East of Nachar but about Gaura it occurs at elevations of 8,000 and 9,000'.

[*Vivia innominatus* (Burton). Speckled Piculet.  
Said by Stoliczka to occur about Sarahan.]

*Megalaema virens marshallorum* Swinhoe. Great Himalayan Barbet.  
Common as far as Taranda.

\**Cuculus canorus canorus* L. Common Cuckoo.  
Common as far as Pangri.

\**Cuculus optatus* Gould. Himalayan Cuckoo.  
Heard almost as frequently as the last as far as Chini. Not mentioned by Stoliczka.

\**Cuculus poliocephalus poliocephalus* Lath. Small Cuckoo.  
Obtained in June at Chini, Sungri and Bagi and also met with between Narkanda and Matiana. Stoliczka remarked that it was 'very rare in the interior of the N.-W. Himalayas'.

\**Hierococcyx sparveroides* Vigors. Large Hawk Cuckoo.  
First heard between Bahli and Sungri and then frequently round about Bagi. The birds were calling high up in densely foliated trees, and it was with considerable difficulty that a specimen was secured on Mount Hathu, between Bagi and Narkanda.

*Clamator jecobinus* (Bodd.). Pied Crested Cuckoo.  
First observed at Sarahan on June 11 and subsequently seen at Matiana.

*Psittacula cyanocephala* (L.). Blossom-headed Paroquet.  
Only seen in the neighbourhood of Sungri.

[*Psittacula schisticeps* (Hodgs.).  
Stoliczka says that this Paroquet is rather common in the neighbourhood of Chini, where he found it breeding. He adds that towards the end of August 'its shrieking voice may be heard between Sarahan and Nachar almost in every ravine wherever the elder and the elm are abundant, on the seeds of which it principally feeds'.]

*Upupa epops* L. Hoopoe.  
Seen at Nirth, Rampur, Sarahan, Nachar and Sungri.

*Micropus melba* (L.). Alpine Swift.

*Micropus pacificus* Lath. White-rumped Swift.  
Alpine Swifts were seen in company with what I took to be *M. pacificus* at Gaura and Bahli.

*Micropus apus* (L.). Common Swift.  
What appeared to be this species was seen sparingly at Chini and in considerable numbers at Pangri and Kanam.

[*Asio otus* (L.). Long-eared Owl.  
Stoliczka says that he found this Owl common near Nachar.]

[*Strix nivicola* (Blyth). Himalayan Wood-Owl.  
Stoliczka obtained it at Chini and an Owl seen there by my shikari was probably of this species.]

[*Otus spilocephalus* (Blyth). Spotted Scops Owl.  
What was believed to be the call of this Owl was heard during the night at Taklech.]

## BIRDS ON THE HINDUSTAN-TIBET ROAD

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\**Glaucidium brodei brodei* (Burton). Western Collared Pigmy Owlet.  
Met with at Bahli and Bagi.

*Gyps himalayensis* Hume. Himalayan Vulture.  
Seen frequently as far as Kanam.

*Neophron percnopterus* (L.). White Scavenger Vulture.  
Observed at Narkanda, Rampur, Gaura and Taranda in April and at Sarahan in June. Stoliczka says 'often seen in summer in the lower ranges about Belaspoor and Suket, but is almost never to be observed further in the interior'.

*Gypaëtus barbatus* (L.). Bearded Vulture.  
Noted at Pangi, Chaura and Bagi. Stoliczka remarked that it was common all through the Sutlej Valley and permanently resided about Chini.

*Falco subbuteo* (L.). Hobby.  
A pair was seen frequently about Nachar in May. They were much worried by Jungle Crows and were still there when I returned a month later.

\**Falco tinnunculus tinnunculus* L. Kestrel.  
Observed between Thanedar and Nirth, about Sarahan and Taranda, and at Pangi and Chini. A pair was seen feeding well-grown young on a ledge immediately above the road at Sarahan on June 12.

*Aquila chrysaëtos daphanea* Hodgs. Golden Eagle.  
I saw what I thought was a pair of Golden Eagles on the wing between Matiana and Narkanda on April 14. Mr. C. H. Donald, who has taken nests near Bagi, Daranghati and Kilba (opposite Urni) states that it is 'to be met with right along the Sutlej watershed, from Kotegarh to the Kailas Range, in suitable localities' (J.B.N.H.S., xxvi, 632).

*Milvus migrans* (Bodd.). Common Pariah Kite.  
Only seen at Rampur.

\**Accipiter nisus melanoschistos* Hume. Indian Sparrow Hawk.  
A male was obtained near Namgia.

\**Spenocercus spheonurus spheonurus* (Vigors). Wedge-tailed Green Pigeon.  
One of a pair was secured at Gaura.

*Columba livia* Gmel. Blue Rock Pigeon.  
Common in the river gorge between Poo and Namgia.

\**Streptopelia orientalis meena* Sykes. Indian Rufous Turtle Dove.  
Common as far as Nachar and frequently seen from Chini to Kanam. Stoliczka says 'is only found in summer in the lesser ranges and does not go far in the interior. I have not seen it beyond Kotegarh.'

[*Dendrotreron hodgsoni* (Vigors). Speckled Wood Pigeon.  
Stoliczka found this Pigeon 'tolerably common near Chini and somewhat further to east'.]

*Streptopelia senegalensis* (L.). Little Brown Dove.  
Only seen round about Thanedar and Nirth.

[*Catreus wallichii* (Hardw.). Cheer Pheasant.  
Stoliczka says 'does not usually go beyond Nachar forests. Said to be very rare near Chini'.]

\**Pucrasia macrolopha macrolopha* (Less.). Koklas Pheasant.  
Seen round about Narkanda, above Gaura and at Daranghati.

**Gennaeus hamiltoni** (Griff.). White-crested Kallj Pheasant.  
Stoliczka says that this Pheasant occurs at Chini.]

**Lophoceros impejanus** (Lath.). Monal.

Seen above Taranda and at Daranghati. Its feathers were found in a Willow-Warbler's nest above Nachar.

**Arborophila torqueola** Valenc. Hill-Partridge.

Several were heard calling between Bagi and Narkanda.

**\*Alectoris graeca chukar** (Gray). Chukor.

Heard calling below Nachar and Sungri and many coveys were seen between Kanam and Namgia.

**Francolinus francolinus** (L.). Black Partridge.

Common at Sarahan. Also seen at Nirth, Taklech and Matiana and below Bahli and Sungri.

**Tetrogallus** sp.? Snow-Cock.

A solitary bird was seen above Namgia.

[**Scolopax rusticola** (L.). Woodcock.

Stoliczka says that the Woodcock breeds about and beyond Chini.]

## TROUT OF TRAVANCORE

BY

W. S. S. MACKAY

[Continued from Vol. 45, No. 3 (1945) p. 373.]

### PART II

(With 2 plates)

#### VI.—RIVER AND HATCHERY IMPROVEMENT.

Under ideal conditions Rainbows would have shade, fast running water, gravel, and rocky runs leading into deep pools overhung with trees and bushes. Such conditions are to be found on the Rajamallay river and prophecies of success there made previously had been more than fully justified by 1945.

Rainbows like the fast rocky runs of a river and generally seek them out. Brown Trout on the other hand prefer quiet pools and slow running flats such as Upper Eruvikulam. Rainbows however lose none of their fighting qualities if placed in such water, a fact that is amply borne out by our fine fighters in the Devicolam Loch. Most of the Rajamallay river is fishable but there are certain barren reaches which would soon hold trout if the judicious construction of dams here and there, was undertaken. Much the same applies to the Turner's Valley river, though this water is teeming with small fish. We are of the opinion that in connection with the rivers on Hamilton's Plateau, there is an absence of predatory life, and that little or no interference with the spawning beds other than possible spates from the N. E. Monsoon can

be anticipated. From the number of trout seen at Poovar on the last inspection one might be led to believe that something like 25% of the eggs laid by wild fish here hatch out and come through to maturity.

Generally speaking, we have at Rajamallay the nearest thing to ideal conditions for Rainbows obtainable.

Turning for a moment to the other side of the picture, to Devicolam, a loch which has already proved its popularity, but which can hardly be called ideal water. Work must be undertaken here to speed up the flow of the feeder stream which can be done by the construction of a series of small dams. In making dams for a sluggish stream such as this, it should be remembered that three one-foot dams are of more use than one of say four feet. The more aeration the better, particularly where temperatures are inclined to be high. Next comes the 'Problem of Mud' which may also be called the 'Anglers' Nightmare'. Mud may be composed of mineral matter such as sand, clay, and mica. This is probably harmless, but the black mud of Chittavurrai, and parts of Devicolam, which is made up of rotting vegetation and plant life, is dangerous and sometimes fatal, and when it is stirred up gives off a most unpleasant sulphurous smell. The centre of such heaps are lacking in oxygen, and foul smelling gases are formed. When the mud is exposed to the air or well aerated water, oxygen is used up very quickly and the sulphide gases are exceedingly poisonous to fish. It is therefore quite obvious that at Devicolam where the water already lacks aeration, steps should be taken to control mud to the maximum extent. In England, mud is sometimes controlled by a series of hurdle batteries. When sufficient mud collects behind the hurdles selective weeds are planted in it, and in this way the harmful properties of the mud are gradually dissipated.

In cutting back reeds or overgrown weeds it should be unnecessary to mention that the cut stuff should on no account be thrown back into the water, but should be carefully collected and heaped on the bank for burning. Rotting vegetation soon uses up valuable oxygen supplies and that part of the water where it had been left might soon be rendered quite useless.

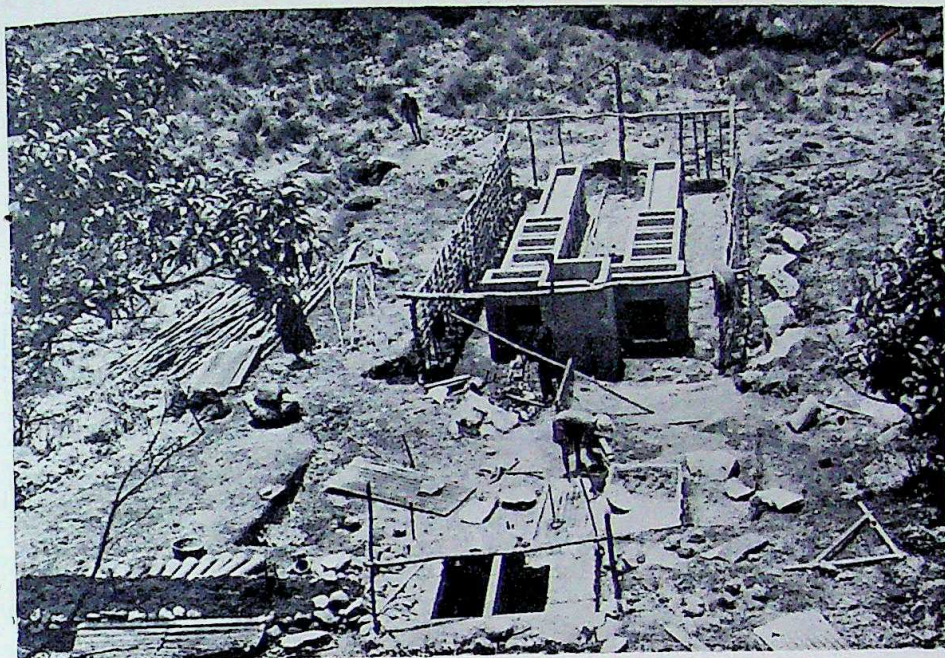
All these observations to some extent apply to the hatchery, but here the river and ponds are under constant supervision, and cleaning etc., is carried out under ordinary routine.

And now a word about otters. It is thought that the common Indian Otter (*Lutra Nair*) (Tamil, *Nir Nye*) is a much maligned animal. There is no doubt that he is a sporting 'jolly little dog' and we love nothing better than to watch him at play. At times however he can be a destructive pest and given the opportunity will kill fish by the hundred, far in excess of his own food requirements. We recently experienced most bitter examples of his capabilities in this direction. The run from the big pond at the hatchery was, until quite recently, unscreened, and there can be no doubt that these little robbers succeeded in getting away with several

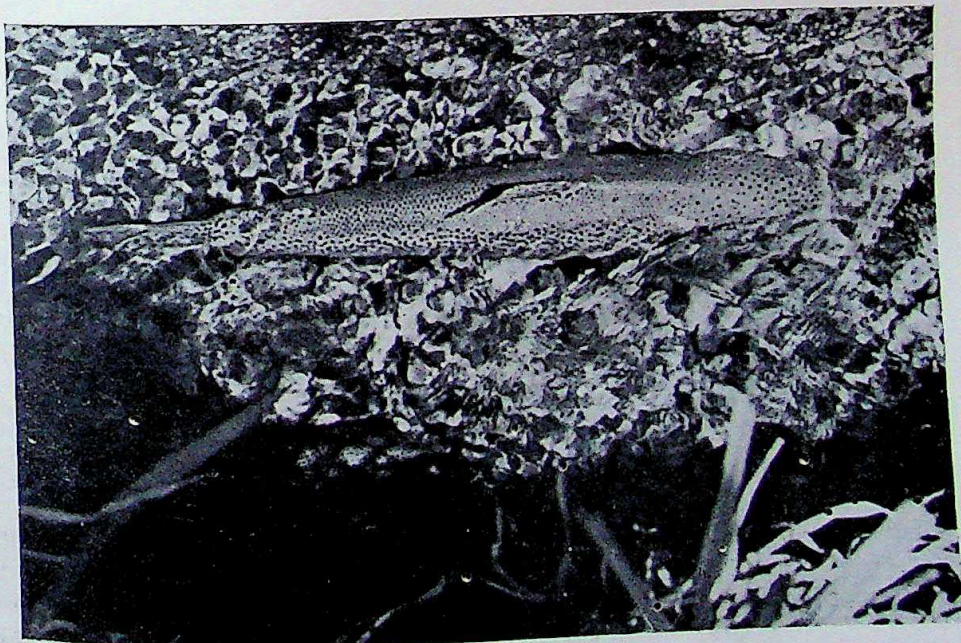
brace of fine three-year-olds which had come up to spawn. On another occasion otters succeeded in getting into the 'stews' for yearlings, and took no less than 300 fine trout in one night. Wire mesh fences set into the ground to a depth of about one foot and sloped outwards, to 6' above the ground have proved most satisfactory in keeping otters out of the stews. A wild spawner taken from the river in 1944 had its nose, and the side of the gills, torn away in a manner suggesting that it had been attacked by a cat. It was thought that this must have been the work of a wild cat or jackal. The latter feed freely on crabs, and a large trout coming into the shallows at night would prove an easy prey. The Brown Mongoose (*Herpestes fuscus*) should also be on the black list.

Hatchery improvement during the year 1942-43 consisted principally of the construction of a large pond for breeders. Water was diverted from the main stream into a natural ravine at the bottom of which a concrete dam was constructed. The water is exhausted over this dam into the river, below, about 100 yards from the intake. Surface water is also taken off by concrete boxes, each 18" x 9", which fit into one another, control the level of the water, and facilitate drainage when the pond is due to be cleaned out. Absolute control is of course necessary in constructing any sort of fish pond as otherwise it would be impossible to undertake cleaning efficiently. We have now at the hatchery, four stews, four grading tanks, and the large pond or 'stew' for breeders. For our own requirements this is ample accommodation, though of course trout should never be overcrowded. The figure given at home for two-year olds is one trout to one cubic yard. Out here at least five times that space should be allowed in our opinion.

From the new pond, spawners first began to come up the run in November 1943. Wild fish were showing signs of spawning about a month before that and up to the end of January. A small percentage of eggs from natural redds and wild spawners were taken. These eggs are usually much healthier in appearance and it is desirable to collect as many of them as possible. The trapping of wild spawners presented some difficulty owing to transport restrictions and pressure of other work on the Estate. Spawners were trapped in the main Rajamallay river and the Aneikad river which joins the former above the Swing Bridge pool. There are many perfect natural spawning beds in this area. Early each morning men are sent out to look for fish, and as soon as these are discovered on the redds suitable lengths of wire mesh of the kind generally used for withering green leaf in the tea factories, are stretched across the river above and below the runs. These improvised fences are quickly clamped down with stones and supported with stakes. The spawners are then netted and stripped on the spot, the ova being taken up to the hatchery in a galvanised pail. It is an interesting provision



Rajamallay Hatchery under construction.



A trout coming up the spawning run.

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गुरुदत्त महाराज

of nature that eggs will stand a certain amount of movement immediately after impregnation, and there is thus no difficulty in carrying them a distance of three or four miles, provided the sun is kept off them with a damp towel. A fine hen fish 24½" in length was tailed under a bank and placed in one of these screened runs. She appeared to be a ripe fish but there was a hard spot round the vent and after a month she still showed no signs of laying.

We will conclude this chapter with the observations that while the eggs of wild fish appear in every way more desirable than those of pond fish, the cost of obtaining it is very considerably greater.

Also the eggs of wild fish seem to be more delicate, though it is not quite clear why this should be. The acid test is fertility and the colour of the eggs has nothing to do with it. Provided well shaped alevins hatch out then the rest is merely a matter of correct feeding and sanitation. The rich pink of eggs from some wild fish is a question of feeding entirely and shows that they have come from water rich in crustaceous food.

#### VII.—TRANSPORT, STOCKING AND RIVER MANAGEMENT

*Transport.*—Transport from the hatchery has been carried out to all parts of the Concession, mostly by cooly headload. Where possible, trout are taken in fish carriers by lorry. This can easily be done where roads lead to the water, but transport to Eruvikulam and the Sambumallay river is undertaken in half a day by headload from the hatchery.

A big undertaking in connection with fish transport was completed successfully in 1942. This was the stocking of the Pooar river in the remote areas lying towards the Northern boundaries of the Company's Concession. This is a river notable for its beauty and fishing possibilities, and it has been the dream of many, interested in trout culture, to see it stocked. It has always been our policy to undertake headload transport in the height of the monsoon, it being argued that at such a time the danger of the water in the fish carriers overheating, or running out of oxygen, was minimised. Such expeditions, however, called for great hardship and endurance from the labour, and those in charge of the operations, so that it was decided that the Pooar project should be engaged upon in two stages, and in comparatively fine weather.

A stew pond was made at Eruvikulam, and on the first day the fry were successfully brought there without mishap, a distance of about 12 miles. Unfortunately the sides of the stew pond had been made flush with the bank, and only about 18" above the level of the water. Consequently during the night a few fry succeeded in jumping out and wriggling their way into the grass, where they were found dead in the morning.

The carriers used for headload transport are ordinary earthenware jars made locally, and fitted with a perforated metal cover-

ing. They form the most excellent carriers and the water keeps remarkably cool, even at noon on a hot day.

On the second day of the transport the weather was so fine that we were able to film the whole proceeding from the start at dawn, to the actual liberation of the fish. This half of the journey, over a distance of eight miles, was a difficult undertaking on account of the percipitous nature of the country and the absence of any sort of path other than the rough game tracks, a network of which are to be found everywhere on the grass hills. The expedition arrived shortly after noon and it was found that the temperature of the water in the river was 4 degrees below that of the water in the carriers. The process of liberating the fish had therefore to be carried out with great care and two hours were occupied in bringing the temperatures together, by the gradual application of river water.

In stocking a virgin river the correct procedure is to commence as near the source as possible, and to dibble the trout out in families of seven or so, at intervals, downstream. Hatchery bred fry tend to keep together in swarms and if this is not done they become an easy prey for their natural enemies. Although the work was carried out very carefully, fry were actually seen in the river well over a mile below the point where the last had been liberated, on the same evening, thus showing at what rate they will move off down stream.

It should have been mentioned that an experimental transport of 100 fry had been undertaken some months previously, in February 1942. The fish of this stocking were seen rising freely down the river, and in 1943 a number were caught weighing 2 lbs. What was still more gratifying, however, was that their sons and daughters were seen in numbers in May 1943, thus proving another stream to be successful, from the breeding point of view. In 1944 a stream in British India 35 miles from the Hatchery was successfully stocked with Rajamallay yearlings.

We have studied in the foregoing a brief history of the introduction of trout of Travancore, and something of the lessons learnt in the hatching and transport of these fish. Let us now turn to a study of the fish itself, and, later, to a very important item, the question of *overstocking*.

The first trout tried out in Travancore was the Brown Trout (*Salmo fario*) which is indigenous to Scotland, and nowhere excelled for beauty and sport, unless by its first cousin the Loch Leven Trout (*Salmo levinensis*) believed by many to be the same fish. It was discovered, that though these trout had all the apparent qualifications for success in our waters, they would not stand such a high range of temperature as we experience here. In consequence breeding was upset, the sexes never being in season at the same time. The Rainbow Trout successful in Ceylon and the Nilgiris was next introduced with undoubted success, but let us try to study the actual degree of success obtained, and probable difficulties of the future.

*The Migratory Instinct.*—We came into close contact with the Rainbow Trout only after coming to the East, and for what little knowledge we now possess we are indebted to Mr. Fowke of Ceylon who appears to have arrived at the answers to the most of the problems. Mr. Wilson H. Armistead in his book 'Trout Waters' refers to the introduction of Rainbow Trout from America, in 1900, to the British Isles, while in 'Fish Farming for Pleasure and Profit', Rainbow Trout (*Salmo irideus*) are referred to as being native of the country extending from California near the Mexican Boundary to Southern Alaska. Mr. Fowke states that the pure Rainbow (*Salmo shasta*) is a river fish, whereas *Salmo irideus* which should properly be called the Steelhead, is anadromous, that is to say, it lives in the sea like a salmon, and has to come to fresh water to spawn. The two varieties are so alike that it is only by careful scale counting and vertebrae counting, that they can be accurately distinguished. Our trout are a cross between the two and the resultant fry in which the Steelhead predominates, will make for the sea at a certain age, while those in which the Rainbow predominates, are left behind. Trout have been caught in our waters which in some respects resemble the Scottish Brown Trout. Is some interesting change taking place due to our local conditions? The theory that cross breeding with Brown Trout had taken place previously either in the Nilgiris or in Ceylon does not seem to have any foundation.

In Travancore the artificial ponds, holding only muddy water and with no proper inlet stream, were a failure. Here the trout put on tremendous weight in the first two years, disappeared, or died in the mud. *Loch Finlay* a splendid sheet of water, but lacking aeration and a feeder stream, was a partial success only; the trout seemed to do quite well in the first and second years, and then disappeared. Here also it was thought that trout had developed one of these strange diseases to which Rainbows placed in stagnant water are prone. The *Devicolam Loch* had proved a 90 per cent success but required restocking every second year. The Loch is fed by a good stream and weed and shade is plentiful. Rainbows require plenty of food and plenty of shade to be successful, and Devicolam has both assets. Lack of shade might cause ophthalmic trouble, a point sometimes overlooked. *Eruvikulam*, 7158' above sea level had proved a great success and natural breeding took place from the very first. The original trout grew to a tremendous size, some close on five pounds having been caught. Most of these disappeared in the third year and in company with many other trout went down over the falls into Turner's Valley, a drop of 1000'. That trout have actually reached the Lower Vagavurrai Estate, an elevation of 4540' is an established fact, and from that, it is safe to assume that many have reached the borders of Travancore, an elevation of 1480'.

A trout can adapt its temperature to that of the water it travels through, and Mr. Fowke has successfully moved trout in Ceylon from a temperature of 56° to 83°.

The question of what happens to our trout when they leave our highland areas is a contentious one, and a subject upon which none of us are at the moment in a position to debate. The natural breeding at Eruvikulam has been augmented with fry from the Rajamallay Hatchery, with the result that the head waters have now been so overstocked that the pound trout is the exception rather than the rule. As a result, further stocking has been postponed meantime, but it is a great pity that the larders were not more sparingly used, and thus a higher weight average maintained for a little longer. The waters here lack shade, but this is being planted up gradually. The *Turner's Valley* stream stocks itself from Eruvikulam, but trout tend to congregate here either at the top, near the falls, or at the bottom, where the river enters the forest. This is because good deep pools with shade and shelter for the dry weather months are not available in the intermediate stretch. Much river work such as the construction of stone dams and deflectors to create good holding water throughout the whole valley remains to be done. The First *Turner's Valley* trout was caught by Mr. E. H. Francis on 27th October 1941, weighed 1lb.

The *Sambumallay River* which is within 20 minutes' walk of the Eruvikulam camp is a small river containing a few pools at the bottom. It is excellent water in which small trout are thriving. The river at *Kanniamallay* is holding trout. The head waters of this stream come through the tea for about two miles and the river is subject to spates of dirty water. It is very doubtful if natural spawning will take place. The *Rajamallay River* contains several miles of splendid water, with deep pools and cataracts, very reminiscent of the highland streams of Scotland. So far it seems that trout are going to do well there. The water was first stocked with a few trout in 1941 and these were liberated on the slopes of Aneimudi. The summit of Aneimudi is 8840' above sea level, and the trout were probably put out at 7500'. These worked downstream but not quite so rapidly as in other rivers. In March 1943 a hen fish which had died spawn bound, was taken from the river some three miles below. It weighed 8 lbs. and was 25" in length! This is another example of what can happen when a few of these trout are liberated in such well stocked larders as our Highland streams in Travancore. But let us beware of using up these valuable larders indiscriminately. Rather let us see to it that we preserve them and where possible increase them. Let us preserve our trees and shrubs, on the river banks, and where there is no shade let our motto be PLANT, PLANT, PLANT. The penalty for cutting trees should be death! Clumps of Black Wattle are being encouraged, and also *Hakea saligna* (The Needlewood tree of Queensland), but it is difficult to find a suitable tree which will thrive under such inclement weather conditions as exist in the monsoon months. However the work MUST go on from year to year, or many of our present gains may be lost. Aquatic plants (Watercress) (*Nasturtium officinale*) and grasses have been successfully brought from Chittavurrai and Devicolam and established in ponds at the hatchery. The Raja-

malay river in common with most of our best water rises close to Hamilton's Plateau, which is the principle water shed in these hills. It is, however, subject to even greater spates than probably elsewhere, on account of the fact that the South West face of Aneimudi upon which it rises, receives the full blast of every monsoon burst. The average rainfall, taken a few miles below the hatchery, amounts to no less than 315 inches over the last ten years, and on 13th July 1943, 22" of rain was measured between the hours of 6 p.m. and 8 a.m. It is therefore useless to attempt planting weeds by artificial means in the main streams under such conditions. The answer is to make experiments in side streams and ponds not subject to serious floods.

About three miles below the hatchery, the river flattens out into a swamp which has recently as 1926 was the home of Elephants and Bison, and a place well known to 'Shikaris'. Sil from the clearings has turned most of this swamp into a sand bank through which the river flows at an almost imperceptible pace. At the corners of the river there are several exceedingly deep pools overhung with jungle trees, and in these, many trout averaging not less than two pounds have been located. Their age cannot be greater than three years, and we are convinced that several of them are over 5 pounds in weight, judging from the one already referred to as having been found spawnbound. Below the swamp the river falls away into rapids and great pools overhung by rocks. The man who has the luck to hook one of these monsters in such heavy water will have an experience worth remembering.

Since writing the above, several trout were caught at night on a fly resembling a Peter Ross, but with a woodcock wing. Their weights were from 2 to 5 lbs. 12 oz. The stomach of one trout of 2 lbs. was crammed full of recently devoured and quite undigested fresh water shrimps, 87 of them, no less. The voracious habits of the Rainbow are truly remarkable. Once again we say, for indeed it can never be too often said, 'BEWARE OF OVERSTOCKING', and explore all methods of food conservation.

The importation of the eyed ova of the pure American Rainbow Trout (*Salmo shasta*) and Brown Trout (*Salmo fario*) has been advocated. This might be done but the writer can see no advantage in such an undertaking, or in what direction the fishing would be improved. Our hybrid trout which can never return from the Sea if they ever reach it, and which can therefore safely be called Rainbow, are hardy, sporting, and prolific, and seem well suited to our water. What more can be wanted?

The growth rate of trout is governed solely by the amount of feed available, so that in the hatchery it is possible to tell the exact amount of food required to grow a pound of flesh. We have already seen what our trout can do when liberated in such virgin waters as Eruvikulam and Poovar. We have also seen, alas, how quickly food stocks deteriorate and how quickly the weight average falls. Our future policy must centre round two very important points. These are:—(a) conserve and increase the food content

of our streams and (b) keep a sound balance between food and stock, by increasing limits, or netting, where water has already been overstocked.

Since writing the foregoing the question why big trout die spawnbound has been asked. Unless trout have suitable conditions they lose the incentive to spawn, though the ova continues to develop until eventually the mass so formed presses against the pericardium and heart causing death. Trout must have low temperatures and range with access to shallow evenly running water flowing over gravel and small stones. Semi-stagnant or muddy conditions upsets metabolism particularly in the case of these fish which, as has already been explained, are to a great extent migratory.

The broad principles of Trout Stream improvement as they apply to the High Range were dealt with in a supplement to the General Report for the season 1944-45. In this work great stress was laid upon the necessity for making the best use of natural food reservoirs. Ditches and side streams can by judicious management be made to maintain large stocks of many fresh water animals. Shrimps (*Gammarus pulex*) will breed freely all the year round and their introduction to almost any class of water is no very difficult matter. In conjunction with shrimps, snails (*Paludomus stomatodon*) which are very prolific in our waters, can be introduced. Often old game wallows or hollows below the level of the main stream can be turned into excellent food farms by diverting water through a channel and controlling the level and the pace of the water through the artificial pond so formed, by means of sluice gates. In such ponds vast supplies of the natural food of trout can be built up and maintained, and from time to time a proportion of this can be induced to make for the main stream by opening up the gates. Any such work on food conservation is absolutely invaluable.

#### VIII.—SOME FISHING INCIDENTS

This work will, I am told, be incomplete without some reference to fishing itself. So many factors of wind and weather, and other conditions, come into the question, that when I am asked what are the best flies to use on our rivers I am unable to give an answer. The ancient 'Book of St. Albans' mentions twelve flies. The 'Dunfly', body of dun wool and the wings of the partridge would appear to be the oldest and most popular. The best known after the 'Duns' are the 'March Browns' and the 'Greenwell's Glory,' and on most brown trout streams at home these take as big baskets as any other fly. A long list of new-fangled flies has crept in. The list is so long in fact that one's brain reels on attempting to memorise it. A great many are mere 'catch pennies', for nothing looks more attractive and alluring than a host of flies neatly set out in the tackle expert's shop. Many trout are taken on small salmon flies, and such new inventions, with silver bodies, as the 'Butcher' and 'Peter Ross' which

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are really lures. In some respects the capture of fish with them is tantamount to spinning, as they suggest the small fry of indigenous fish found in most waters, but certainly the bigger trout are often caught that way, which is a very good thing indeed. It has been stated that the Rainbow Trout is easier to catch than his cousin *Salmo fario*, and at certain times of the year this is undoubtedly true. The Rainbow Trout often accepts a big variety of flies under similar fishing conditions. In my experience the never-failing fly or lure contains red, with either a teal or woodcock wing, but when the water is heavy the silver body is very deadly. For the late evening a black fly with a silver twist, red hackle, and jungle cock wing such as Watson's Fancy does good work, and late at night the Teal and Silver. Rainbow trout when they are on the feed are much less 'gut shy' than the Brown, and if anything the splash of a badly cast fly seems to attract them. It is necessary, however, under almost all conditions, to keep well out of sight. I know of a pool on one of our rivers where big trout lie. The head of the pool contains many rocks and boulders affording the most magnificent sanctuary for wary trout. The 'hing' or end of the pool is full of gravel and sand, and the big trout if undisturbed, will lie there throughout most of the sunny part of the day. I always found great difficulty in approaching this pool and on each occasion managed somehow to give myself away. At last I discovered an infallible line of approach, some trick of the light, or the particular location of the pool, making all others impossible. Having got into position I began very carefully to look from behind the 'hide out', and soon discovered two of the trout lying in their favourite spot. When a light breeze sprang up I cast and immediately hooked one of the fish which on being netted was found to weigh two pounds. When big wary trout are lying in clear water they can be caught if patience, combined with careful observations, are applied.

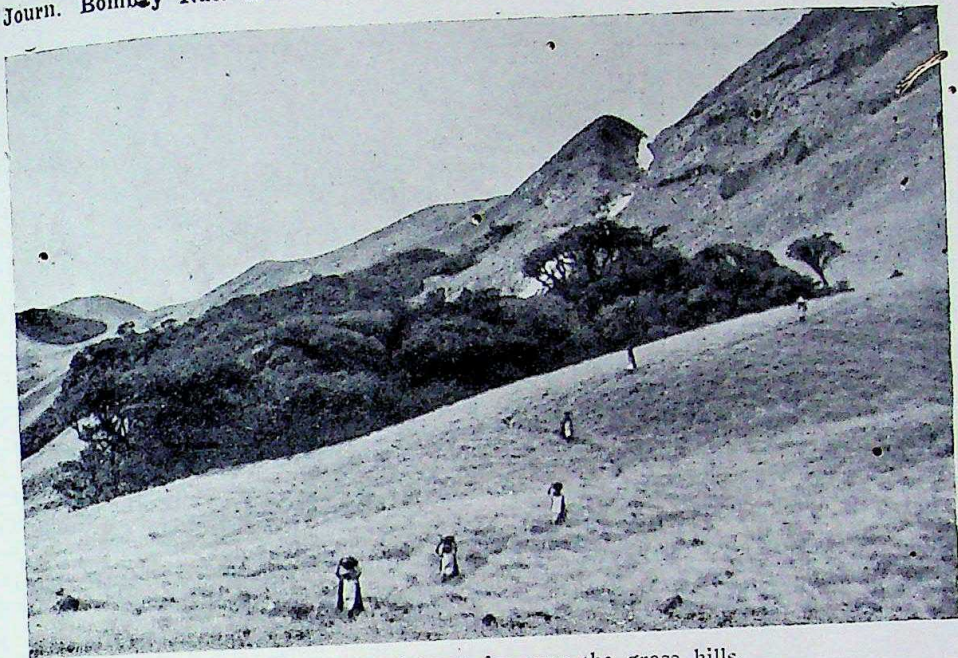
At nearly all times of the year the floating fly will do well on Upper Eruvikulam and most of the Pooar river. One year the fishing in April and May fell off very badly and for a month no records were sent in except those of a keen dry fly fisherman who consistently collected 2 or 3 brace of trout, particularly on windy days.

The waters of the High Range will in time, all provide sport of the very finest, but the cost of the success to date has been heavy, and the Company and their employees have borne the whole expense themselves. It is therefore no wonder that so far the waters which are private, are seldom open to visitors, though occasionally a guest of the Company is granted permission for a day on one or other of the streams or lochs.

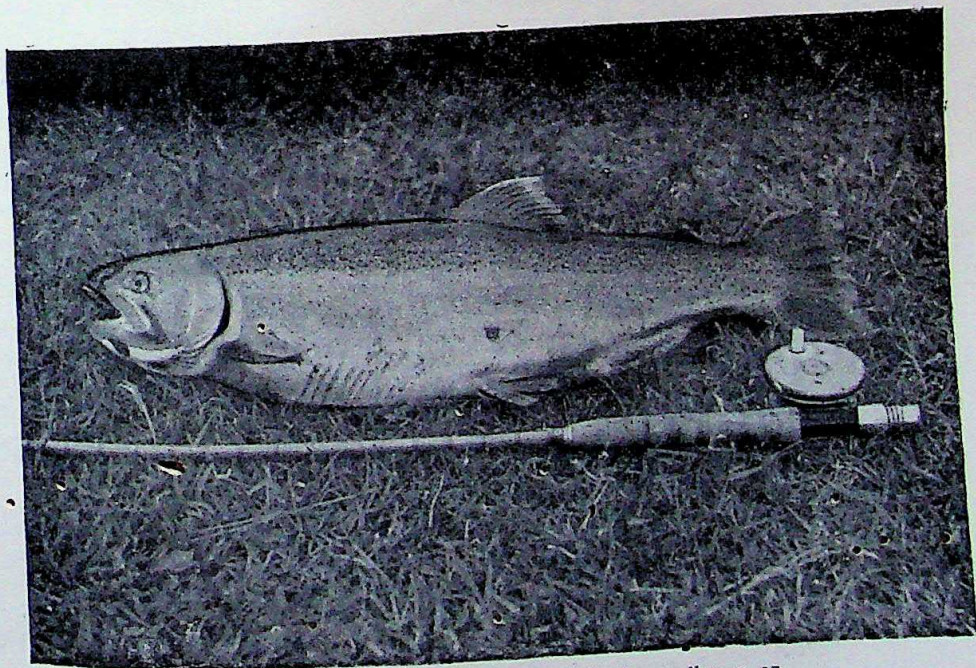
The following is an extract from the author's Fishing Record Book:—'The Eruvikulam River falls into Turner's Valley and then winds its way through grassland and jungle, eastwards and then North eastwards towards the plains and the Coleroon which it ultimately joins. After leaving Turner's Valley it falls away sharply in a series of great falls and cascades towards Luckham

and the Lower Vagavurrai Tea Estate, where there is a famous pool called the Luckham pool. In February 1944 an old planter who has been connected with sport in these hills for many years, reported trout in this water. The elevation is about 4,100' above sea level here, but as the water pours straight off the high hill temperatures probably do not exceed 65° at the hottest time of the year. All the water from this point downwards for some miles, is in every respect ideal, although it is very unlikely that trout will breed successfully in it. On the night of 29th February 1944, I went with this planter down to the pool to try a cast or two. Towards 7 o'clock a big trout came into the shallows at the mouth of the pool together with three or four smaller ones. In crossing the river however I fell and smashed the point of my rod just above the last rung but one. This made further fishing exceedingly difficult, for with each cast the line whipped itself round the broken end of the top joint. But for the moment the big trout had disappeared into the black depths of the pool. The light was going fast when its shadowy form appeared again in the shallows, and several casts were made over it with a large fly, "a grouse and claret". Suddenly when hope had been given up, the fish took the fly with a tremendous splash and was off like an express train into the centre of the pool, but I fortunately had the presence of mind to lower the point of my rod after striking, thus freeing the line. The fish rolled several times like a salmon, and then came back to the shallows, but after the initial rush it gave little trouble, although with the anxiety of the broken rod and the thought that it was very lightly hooked and the cast-frayed the final outcome was in doubt up to the last moment when it was netted successfully. It was immediately taken up to the Factory and accurately weighed there at 7 lbs. 2 ozs. It was 24 $\frac{3}{4}$ " in length and had a girth of 15 $\frac{1}{4}$ ". It was a hen full of almost mature ova which weighed a pound and a half. The stomach was quite empty arguing that it was a late fish in season and about to spawn. I was of the opinion that it was not spawnbound and that it would have got rid of the eggs within a few weeks. This is the largest trout to be taken on the rod in Travancore, and I have not so far heard of anything bigger in the Nilgiris, though no doubt such fish must have been caught there in the early stages. Trout when they come into season do not feed readily and in many cases probably do not feed at all. A trout in this condition is however either annoyed into taking a fly by its frequent appearance adjacent to a favourite lie, or because the fly represents some insect dangerous to the spawning beds. Mr. Philip Fowke wrote on the 11th March 1944 that this fish broke his long standing record for Ceylon of 6 lbs. 12 ozs.

*Big Trout.*—Other notable trout have already been referred to the biggest of these being the eight-pounder found lying dead in Rajamallay river in 1943. Mr. E. H. Francis caught fish of 4 $\frac{1}{2}$  lbs. to 4 $\frac{3}{4}$  lbs. on several occasions. The visit of Major-General (now Lieut.-General) E. F. Norton, C.B., D.S.O., M.C., in 1939 when six trout were caught weighing 20 lbs. has also been



Transport of trout fry over the grass hills.



Record trout for South India—7 lbs. 2 oz.



referred to. The biggest in that basket was caught by the General on a dry fly and weighed  $4\frac{1}{2}$  lbs. One of the biggest trout recorded previously, came from the Chittavurrai Lake. It was  $5\frac{1}{2}$  lbs. and was caught by Philip Gouldsbury who was also connected with the early efforts to establish Brown Trout.

Exciting incidents make more pleasant reading than a mere list of records and we will try to glance through the Association's Game Book and recall a few of these. The description of the catching of the first Rainbow Trout at Eruvikulam has already been given. This should have been a signal for the opening of the river to fishing, in the opinion of many, for in the spawning months that followed none of these monsters were seen again. Many of them succeeded in negotiating the 1000' falls in the monsoon and getting into Turner's Valley, where in September 1942 the most perfect specimen of a Rainbow Trout so far seen was caught by Mr. Francis. On that occasion I had received instructions to meet Mr. Francis at a point half-way between the High Range and the Anamallais, the next range of hills, from whence he was walking on an inspection of concession land. It was a longish trek taking in all three days, and on arrival in Turner's Valley on the homeward journey it was about 12 noon, with time enough for a few hours' fishing before proceeding to the last camp. The sky was cloudless and the water clear as gin, but it was decided to try a few casts in the runs towards the end of the valley. At the second or third cast a heavy trout was hooked on a 'teal and silver'. After the first rush the fish bored back into rough water and at such speed that for a time there was several yards of slack in hand. However after a splendid fight the net was slipped under him and a fine trout of  $3\frac{1}{2}$  lbs. was brought to the bank. That was the only trout seen that day but one well worth and even longer trek. Those who are known to have caught trout over four pounds, are only seven in number and as these monster trout will always be few and far between, a note of their names will be of interest.

W. S. S. Mackay from the Luckham Pool	...	7 lbs. 2 ozs. length 24 $\frac{1}{2}$ ".
Philip Gouldsbury at Chittavurrai	...	5 $\frac{1}{2}$ lbs.
E. H. Francis at Eruvikulam and Turner's Valley.	...	2 @ 4 $\frac{1}{2}$ and 1 @ 4 $\frac{1}{2}$ lbs.
Mrs. W. S. S. Mackay at Chittavurrai	...	4 $\frac{1}{2}$ lbs.
Lieut.-General E. F. Norton at Eruvikulam	...	4 $\frac{1}{2}$ lbs.
W. S. S. Mackay at Eruvikulam	...	2 @ 4 $\frac{1}{2}$ and 1 @ 4 lbs.
Alasdair Steven at Rajamallay	...	4 $\frac{1}{2}$ lbs.
W. S. S. Mackay at Rajamallay	...	5 $\frac{1}{2}$ lbs.

It is thought probable that J. S. B. Wallace and J. M. Bridgeman caught trout over 4 lbs. but these were not recorded by the Association.

John Hamilton Wilkes did a great deal of work in connection with stocking the rivers. How he caught his first trout, and gave the name 'Hamilton's Hole' to the Big pool at the bottom of Turner's Valley makes a story worth recording. He had been fishing for some hours without result, when he felt a steady pull on a large salmon fly which he was drawing across the river at a

depth of several feet. With a yell he announced that he was into a fish, that his reel had jammed, and his line became entangled. It will never be quite known how he accomplished it, but without the aid of a free running reel, he succeeded in bringing to the bank a fish weighing  $3\frac{1}{4}$  lbs. which in contrast to the one just mentioned, was one of the ugliest-looking cannibals yet seen in our waters. The fish, a male, had a more than usually pronounced hooked jaw, and was almost yellow in colour, with a deep red line. It took 25 minutes to land but fortunately never made a run out of the pool.

At Devicolam some very big baskets have been recorded. One day in June 1943, 29 trout weighing 29 lbs. 15 oz. were taken, by four rods.

In 6 days' fishing on Hamilton's Plateau two planters from Burma took 75 trout weighing 44 lbs. 12 oz. In March 1945 two rods took 87 trout under the  $\frac{1}{2}$  lb. average, in 6 hours' fishing at Pooar. There is no doubt that when the war is over and those on service return, some even bigger baskets will be recorded. The most killing fly on most occasions seems to have been the 'teal and red' but owing to the difficulty in obtaining proper gut most fishermen handicap themselves by using stuff which is far too thick.

#### IX.—FURTHER FISHING INCIDENTS

'Let us not burden our remembrance  
With a heaviness that's gone'—SHAKESPEARE.

*Trout lost.*—It is a pity that there is no means of recording the stories of trout hooked and lost. Fishermen are generally a trifle reticent on the subject of lost monsters, and I think that as a general rule the lost one seems, in the mind of the fishermen, gigantic, in comparison to those successfully brought to the net. Perhaps the biggest fish ever played for any length of time and finally lost by a piece of ill luck, was at Eruvikulam, when in 1942 the then Chairman of the Association, Mr. H. A. Ragg, was fishing the stretch in the upper waters, from the junction pool, towards the falls. The previous evening a tackle box had been lost, and early in the morning he had gone out unaccompanied, to make a search for it. The box was soon found and he put up his rod to have a cast or two before returning to breakfast. He had no net, but was not unduly worried as no big fish had been reported in this water for some months. At the second or third cast, however, he rose and hooked one of the monsters, no doubt a member of the original batch put in during 1937. There was no use shouting as the camp was too far away for the sound to carry, and it would only have been by a stroke of luck if he had been spotted by one of the watchers. The rod that he was using was a short light affair with which it would have been difficult enough to control a heavy trout in any case, but nevertheless at the end of twenty minutes he had the fish below him,

more or less on its side, and ready for the net. From his position it was apparently quite impossible to tail the fish, but there was a weedy bank a little lower down on which he attempted to beach it. The fish was probably 6 lbs. in weight, but alas it never reached the camp to be correctly weighed. In the effort of trying to beach it, the cast broke close to the fly and slowly the fish recovered itself and swam off into the deeper water beyond.

There have indeed been some very large trout lost at Eruvikulam, and in 1941 Major J. R. S. Mackay hooked one on a small Dyson opposite the Rhododendrons about half-way down the same stretch. The fish took the fly close into the bank and the Major saw it clearly before it made the first rush. He thought that the trout was bigger than any he had caught in many years of fishing, and it certainly fought like an exceptionally heavy one for some seven or eight minutes. By an incredible stroke of ill fortune the knot at the fly slipped and the fish got away.

Though the weight of these lost fish can never be known, it is safe to assume that there are many trout within our concession of 5 lbs. and over and by concentrated night fishing a few of these could no doubt be taken on the fly. Using a teal and silver and perhaps with the help of a maggot or two, big trout can often be persuaded to move. During daytime and late evening they are wary and keep to deep pools and cover.

In 1944 some complaints were heard regarding the falling off in weight averages. These mostly came from fishermen suffering from a 'big fish complex.' Having caught the monster trout which grew in the lakes and rivers in the first year or two after stocking, disappointment was felt when baskets containing only half pounders were the order of the day. As has already been explained trout put on great weights when liberated in virgin water, but the average eventually falls to a standard in direct ratio to the class of water.

If big weight averages are to be obtained trout must have tremendous range with access to and from big water. In the High Range our streams are torrential and there is little or no catchment area between us and the plains. On the West the waters fall in one mighty drop to the plains and the coast of Malabar, while on the East they are broken up by a series of falls and cascades which no fish could ascend. It follows therefore that we can hope to breed only a race of hardy hill trout and if baskets average out at 8 ozs., what more can be expected? With proper river management this might possibly be improved upon, and undoubtedly there will always be the chance of a big one on some of our water. Indeed there are more of these trout about that is properly realised. There are many jungle pools fed by broad stretches of shallow rough water and in the late evening big trout are to be found in these runs.

It is interesting to note that on Hamilton's Plateau there are two rivers within a few minutes' walk of one another which are frequently fished on the same morning. The water from the first flows east and eventually joins the Cauvery and the Coleroon,

while that of the other flows west, and joins the Periyar and the sea near Cochin.

The best and most exciting time for fishing in the High Range is probably just as the South West Monsoon rains begin to abate—that it, if the fishermen are prepared to stick the leeches which on most of our rivers are so bad that for some people the whole joy of the day is lost. Those who are allergic to leeches should avoid the High Range!

There was a break in the weather towards the end of last monsoon and for three whole days the sun shone. On the last day I woke up to the fact that I should be fishing, and sent men down to a favourite beat some miles below the cultivation on the Rajamallay river to light fires and keep a look out for these pestilential elephants. Here there is a fine deep pool of about two acres in extent, fed by a broad stretch of rough rocky but shallow water—a place such as big trout love in the late evening.

The light had almost gone when fishing began above the Pool in the rough water. At the third or fourth cast a pound trout took the bob fly and fought so well that the next fifteen yards or so of water was hopelessly disturbed. Shortly afterwards there was another rise to the bob fly but thereafter nothing, and the impression was that the best of a good late evening rise had been missed. At the tail of the run however the steady pool of a heavy fish was felt and a big trout took the tail fly, a teal and silver, quite quietly, as does a salmon very frequently. Steadily upstream cruised this large trout and presently its dorsal fin was right out of the water and the back of a real 'whopper' displayed itself. As the fish came directly opposite it suddenly seemed to realise that all was not well, for it turned in a flash and was off downstream, and clean across the jungle pool in one glorious rush. Here I made the great mistake of trying to stop it and the line went slack. The cast had held alright, but the line of all things had broken, and then only I realised that lines cannot be expected to last indefinitely even with the greatest care, and that the one in use was seven years old! But that great rush will live in the memory. Indeed it is the stories of these mighty lost ones that live for ever.

*An Experience.*—A point has now been reached in the story of our High Range Trout Culture, from where it is impossible to proceed further. Most of the work now being undertaken centres round important hatchery improvement, *river improvement*, and general observations. In two years' time perhaps, another instalment may be forthcoming and I look forward with hope to writing of success, in a world free from war and misery. In looking over the pages of this report, for it is thus the work should be described, I wondered how many would be really interested in it? It has often been said that fishermen are 'Lunatics' who are born not bred. To some extent that may be true, but I know men who have taken to fishing for the solace and peace of mind a day on the river gives them, for the beautiful places it takes them to, and for the wild bird and animal life they see. To illustrate this point I will record a story. A few days before departing on two

months' local leave, a planter left his Estate to walk over to Sambumallay and Eruvikulam, to have a look at the waters, and to see how things were getting on. It was a clear morning but with wisps of mist floating on the summit of Aneimudi, and as he marched along, he felt he didn't want to go on leave at all, and that all he wanted was to be left alone, to wander about these beautiful hills for the rest of his life. Written up in his shikar diary is a short list of the game he saw that day. On the Vagavurrai rock a fine saddleback, at Neelakal a sounder of pig, at the Junction Pool of Eruvikulam a jungle sheep, on Sambumallay, a herd of 50 Ibex, at the head of Turner's Valley a fine Bull and four cow Bison, at the bottom of Turner's Valley two sambhur hinds, and on the Luckatavurrai another herd of Ibex. It may indeed seem like a romance, but on the same day he saw a spotted panther in the distance. He knew there was a big trout in a pool in the river and his choice was between the panther and the trout. He chose the trout and got him too, and it weighed  $4\frac{1}{2}$  lbs! Such days may be exceptional but they are there for all of us.

*Conclusion.*—Nearly all the resident planters in the High Range and many of the ladies have at one time or another subscribed to the work of the Angling Association, and it would be quite impossible to mention the names of all of them individually. This work cannot however be finally closed without one further reference to the first Chairman of the present Association, A. W. John, who first introduced the Rainbow, and the Secretary, John Muir, J. S. B. Wallace, E. H. Francis, General Managers of the Kanan Devan Hills Produce Company Limited, and Alasdair Steven. These gentlemen revived the experiment in 1932, and stuck to it through its many adversities, and it is to them that the thanks of all the young men who will return from the war and who will enjoy happy days on the lochs and rivers will be due. Those who were left behind to carry on in the High Range during the second Great War, undertook the work of hatching trout and stocking the waters with the additional satisfaction of knowing that they were doing something that would give pleasure to the boys who have been fighting for them in Burma, the Middle East and elsewhere. If when these return they find amongst the hills and upon the rivers that tranquillity for which they must have so often craved, the debt, if such exists, will have been more than fully repaid.

## PROGRESSIVE DESICCATION OF NORTHERN INDIA IN HISTORICAL TIMES.

BY

M. S. RANDHAWA, M.SC., I.C.S., F.N.I.

(With one plate and 2 maps.)

During his studies of the beautiful trees of ancient India the present author came across some interesting evidence, archaeological as well as literary which sheds light on the climate of northern India from Circa 500 B.C. to C. 640 A.D. Most of this evidence is from Mathura region and is based on the study of numerous sculptures recovered from time to time from that district due to the efforts of pioneers like Mr. F. S. Growse, Pt. Radha Kishen, Dr. Fuhrer and others, and now housed in the archaeological museums at Lucknow and Mathura. It shows that about 2,000 years ago the 'Brij' districts which today have a desert vegetation were covered with wet tropical forests containing evergreen trees of Indo-Malayan affinities which flourish at present in Assam, Bengal, Burma, and west coast of India.

This evidence is in conformity with that obtained from the observations of Douglas and Ellsworth Huntington on the annual rings of Sequoia trees of South-western United States. This evidence shows that a very wet period prevailed from C. 100 B.C. to C. 100 A.D. and since then the curve of humidity has a downward trend on the whole with only brief interludes of wetness. Since then aridity has been on the increase though it cannot be said with certainty whether it is due to shifting of climatic zones or due to other causes. Writings of Herodotus show that Western Asia was very wet between 400-500 B.C. The presence of animals of the swamps like elephants and rhinoceros in Sind and the Western Punjab is proved from the seals recovered from Mohenjodaro and Harappa which date from C. 3250 B.C. to C. 2750 B.C. Sind and Western Punjab are practically deserts now, though the evidence from the presence of these denizens of swamps in these regions points towards considerable wetness if we bear the present distribution of elephant and rhinoceros in mind.

### MATHURA SCULPTURES OF WOMAN AND TREE DESIGN.

In excavations carried out at the ancient site of ~~Vankali~~ Tila, about half a mile to the west of the present city of Mathura from 1888-91 A.D. Dr. Fuhrer discovered the remains of a Jaina monastery which proved to be a veritable mine of beautiful sculptures. Many exquisitely carved bracket figures of Woman and Tree (*Salbhanjika*) design were discovered. The sculptors of these figures used spotted red sandstone, similar to that found in the quarries of Tantpore and Fatehpore Sikri in Agra district for carving these

figures. Chronologically these 'Woman and Tree' bracket figures have been ascribed to the Kushana period, from 1 A.D. to 170 A.D.

These bracket figures were described by Vincent Smith<sup>14</sup> in 1901 in a valuable iconographic monograph, but he did not identify any of the trees. It is for the first time that we find Asoka and Kadamba trees mentioned by name in the catalogue of the Mathura Museum compiled by Dr. Vogel in 1910. The remaining two trees have not been identified so far.

A close examination of Mathura sculptures reveals that leaves and flowers of Asoka (*Saraca indica*) was a popular motif of their decorative designs along with flowers and leaves of the lotus. While the elephant, horse, lion, and the antelope were their favourite animals, *Saraca indica* was their favourite tree. In the sculptures displayed in the Curzon Museum of Archaeology at Mathura and Provincial Museum, Lucknow, we find numerous sculptures in which Asoka tree is associated with male and female figures. In the Bacchanalian groups discovered from villages Maholi and Polikhara we find the drooping branches of Asoka with its unmistakable lanceolate leaves and also an inflorescence. On a slab with the figures of a couple feeding a parrot we find the blossoming branch of Asoka on the lower panel. On another fragment we see a squirrel climbing an Asoka tree. On a railing pillar we see a woman standing under a flowering Asoka tree.

Some of the Mathura sculptures displayed in the Provincial Museum, Lucknow, are still more interesting. In one of these we find a beautiful woman with a happy face standing cross-legged on a crouching dwarf, fastening a lotus garland on her head. Behind her we see an exquisitely carved branch of *Saraca indica* with its characteristic lanceolate leaves and ixora-like inflorescence (fig 2), which are so true to nature. In another we see a woman gathering Asoka flowers.

Apart from the Asoka, we find three other trees depicted in these sculptures. In one of these we see a woman under a Kadamba tree (*Anthocephalus indicus* Rich.) displaying a sword dance and touching its ball-like flowers (Fig. 1). The broad ovate leaves with conspicuously marked venation and globose inflorescences are prominent characters of *Anthocephalus indicus* which have been faithfully carved by the sculptor.

The third unidentified tree which we find appears to be Champak (*Michelia champaca* Linn.) and forms a background to a beautiful female figure wearing a peculiar head-dress (Fig. 4). The ovate-lanceolate leaves tapering to a long point, segments of the perianth in three series, oblong sepals and the stalked gynophore with numerous carpels, are characters of *Michelia champaca* Linn., a member of the family *Magnoliaceae*. The cone-like terminal structures appear to be the compound fruit of *Michelia champaca* rather than the flower.

The fourth tree with leaves like an Asoka and comparatively smaller axillary flowers, which we find in a sculpture behind the figure of a woman treading over a dwarf resembles *Mesua ferrea*.

Note.—For Ref. Nos. quoted in the above text see page 565.

Linn. (Fig. 3) the well-known Nagkesar tree of Eastern Bengal, Assam and Burma. Its linear-lanceolate acuminate drooping opposite leaves with short peduncles and axillary solitary flowers resemble those of *Mesua ferrea* rather than of any other Indian tree. *Mesua ferrea* with its strikingly beautiful leaves and highly fragrant flowers must have been as popular in ancient India as it is now in Eastern Bengal and Assam.

The accurate delineation of the foliage and flowers of these four trees, *Saraca indica* Linn., *Mesua ferrea* Linn., *Michelia champaca* Linn., and *Anthocephalus indicus* Rich. suggests that these trees were familiar to the Kushana sculptors from personal observation.

#### PRESENT RESTRICTED DISTRIBUTION OF *Saraca indica* LINN. AND OTHER KUSHANA TREES.

At present *Saraca indica* Linn. has a much more restricted distribution. According to Hooker<sup>9</sup> it is found only in the evergreen forests of the west coast of Bombay, Northern Circars, Khassia Hills, Chittagong, Upper Burma, Arakan, Tennaserim, Ceylon, Andamans, Malaya and lower elevations of Himalayas from Kumaon eastwards. (Map II).

As regards the present distribution of *Michelia champaca* Linn. Hooker<sup>3</sup> mentions: 'It is found wild in the forests of the temperate Himalayas from Nepal eastward, Nilgiris, Travancore, Pegu, Tennaserim, Malaya and Java. Haines<sup>8</sup> mentions Western Ghats, Singhbhum, Palamau, Neterhat and Mayurbhanj in Bihar in addition to the places mentioned by Hooker, and also states that at other places it is cultivated.

*Anthocephalus indicus* Rich. is found in natural condition in North and East Bengal, Western Peninsula, Ceylon, Andamans, Pegu, Malaya, Sumatra, and Borneo, and elsewhere it is cultivated. It is absent from the dry areas of the United Provinces, Delhi and the Punjab. Even in comparatively wet districts of Oudh it is rarely found cultivated in gardens, and if you inquire from people you will find very few who have seen a Kadamba tree, except in the mythological pictures of Krishna. The fourth tree which appears to be *Mesua ferrea* Linn.—the Nagkesar tree is found in Eastern and Northern Bengal, Assam, Eastern Himalayas, North Behar, Orissa, Western Ghats, Burma and Andaman Islands. Elsewhere in India it is cultivated only.

From the above it is apparent that the present distribution of these four trees is almost co-terminous, and the distribution of *Michelia champaca*, *Mesua ferrea* Linn. and *Anthocephalus indicus* Rich. falls in the line with that of *Saraca indica* Linn. A glance at the rainfall map of India, and neighbouring countries shows that these trees are found in the evergreen forests of India, Burma, Ceylon, Malaya and Sumatra with a rainfall of over 80 inches, and particularly *Saraca indica*, *Mesua ferrea* and *Michelia champaca* (Map II). *Saraca indica* is the most moisture loving of all these four trees, and then *Michelia champaca* followed by *Mesua ferrea* and last *Anthocephalus indicus* which can be cultivated in comparatively dry areas. Even in districts of Oudh with a



1



2



3



4



5

Photo by

RANDHAWA.

Progressive desiccation of Northern India in historical times.

(For explanation of the plate  
see end of article.)



rainfall of 40 inches *Saraca indica* grows with great difficulty in gardens as it is very susceptible to hot winds. It is commonly confused with another cultivated South Indian tree, *Polyalthia longifolia*, and even Sanskrit scholars, who ought to know better, call this much less attractive tree Asoka. This shows how completely the people of these parts have forgotten the real Asoka tree due to its extinction in these parts centuries ago.

From the present natural distribution of these four trees and particularly that of *Saraca indica* Linn. one can safely infer that about 2,000 years ago, Mathura district which has almost become a desert with an average rainfall of about 24 inches had a much higher rainfall. It is probable that Mathura and North India enjoyed a comparatively wet and mild tropical climate. This is inferred not only from the presence of tropical trees like *Saraca indica*, *Michelia champaca* and *Mesua ferrea*, but also from the frequent use of lotuses in architecture. In Mathura sculptures we find lintels carved with lotus buds and flowers, and women wearing lotus garlands. The resemblance of the dress of Mathura women with the women of present-day tropical island of Bali who are also undraped from waist upwards is apparent. So the comparative nakedness of the women of Mathura in the Kushan period is not due to sensuousness of the inhabitants, but an adaptation to a mild tropical climate. The wet nature of the country is also proved from the figures of women shown bathing under waterfalls. Waterfalls are found only in rocky places with heavy rainfall.

*Use of aquatic or semi-aquatic animals in sculpture.*—The frequent use of aquatic animals like fish and alligator in decoration of pillars and gate-ways, and of domestic animals like elephants which flourish in heavy forest also point in the same direction.

*Past distribution of Saraca indica* Linn.—The past distribution of *Saraca indica* Linn. in Northern India, the region from which it is absent now is established from archaeological evidence and literary evidence from ancient Sanskrit literature (Map I).

1. *Archaeological Evidence.*—*Saraca indica* Linn. was the most popular tree with the Mathura sculptors of Kushan period, and the presence of this tree in Mathura from Circa 1 A.D. to C. 176 A.D. is well-established from the railing pillar 'Woman and Tree' figures of Mathura. In the sculptures of Sanchi in Central India which date from first century B.C., we also find this tree. In Sanchi sculptures we find a bracket which has been wrongly described by Sir John Marshall as a *Bignonia* tree bracket. The shape and arrangement of its leaves and structure of its flowers show that it is an Asoka tree. We also find a beautiful figure of a woman under an exquisitely carved Asoka tree in sculptures from Barhut in Nagod State, Central India. The Barhut sculptures date from the period of Sungas from 112 B.C. to 72 B.C. In a Ramayana panel of a Gupta temple at Deogarh, near Lalitpore in the Jhansi district, we find the branches of an Asoka tree. Guptas ruled from 320 A.D. to 490 A.D. and in those days this tree was probably flourishing in the now arid district of Jhansi. We also find the Asoka tree depicted in Ajanta paintings dating from 500 A.D.

*Evidence from Sanskrit Literature.*—We find numerous references to the Asoka and the Nipa (*Anthocephalus indicus*) in Sanskrit literature particularly in the Ramayana and Mahabharata, works of Kalidasa, and Harsha's 'Ratnavali'. An author usually incorporates the description of those trees which he observes, and from this point of view the references we find to Asoka and Nipa trees in ancient Sanskrit literature are valuable in ascertaining their distribution.

Macdonnel has concluded that the kernel of the Ramayana was composed between C. 200 B.C. and C. 500 B.C. In the Ramayana it is mentioned that Sita was kept by Ravana in an Asoka grove in Lanka. Asoka trees are still found in Ceylon and the West Coast of Bombay. When Rama returns to Ayodhya after rescuing Sita from Ravana it is described that he bade farewell to his friends and allies and retired in an Asokavatika.

Though it is difficult to be precise about the date when the epic Mahabharata was written, and the place of origin Vyas historians generally agree that it was composed between C. 500 B.C. and C. 400 A.D. From the descriptions which the author has given one may safely presume that he lived somewhere in the area between the Sarasvati and the Ganges. In 'Van Parab' in which the exile of the Pandava is described we find references to Kadamba trees in Dwait forest. This forest existed in the region, covered by the present districts of Saharanpore and Dehra Dun. Similarly we find a reference to Kadamba trees in Kamyak forests which existed south-west of Delhi, and it is likely that the existing Kadamba forests in Mathura and Bharatpore are remnants of this ancient Kamyak forest.

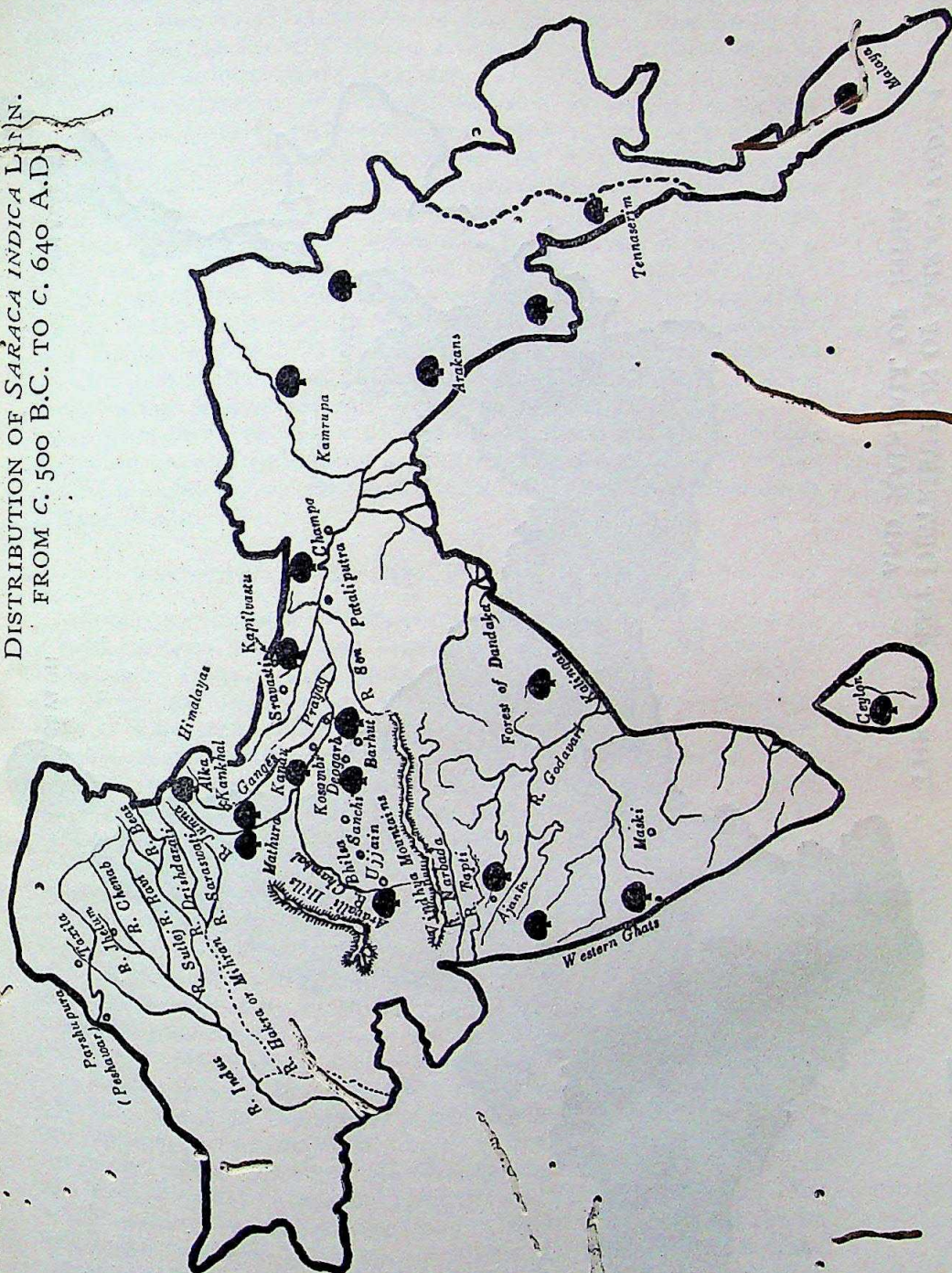
Though it has not been historically established as to when Krishna lived, we at least know that the authors of the epic Mahabharata were familiar with jungles of *Anthocephalus indicus* in the neighbourhood of Mathura, and that is why we find Krishna so intimately associated with this tree. That this is an accurate record is proved from the remains of a Kadamba forest in Mathura.

We find numerous references to the Asoka tree in Buddhist literature. Among the trees associated with the miraculous birth of Buddha which took place in Lumbini garden near Kapilavastu, we find the Asoka tree mentioned along with Mango, Dhak (Plaksa) and Sal trees. In the description of a Buddhist sanctuary, Punnabhadda near Campa we find the Asoka tree conspicuously mentioned. As Ananda Coomaraswamy quotes, 'This sanctuary was encompassed round by a great wood. In the wood was broad mid-space and therein was a fine Asoka tree.'

There is a consensus of opinion among most historians that the famous dramatist Kalidasa was a native of Mawra, and was contemporary of Chandra Gupta, II Vikramaditya and lived between C. 375 to C. 455 A.D. Kalidasa has left us accurate descriptions of the ancient city of Ujjain and from his accounts it is evident that the Asoka tree was common in and about Ujjain.

Kalidasa describes Nipa forests (*Anthocephalus indicus*) near Nichai hill near ~~the~~ <sup>the</sup> ~~city~~ <sup>city</sup>, and along the banks of Reva (Narbada river). He also describes 'a red-bloomed Asoka tree with tremb-

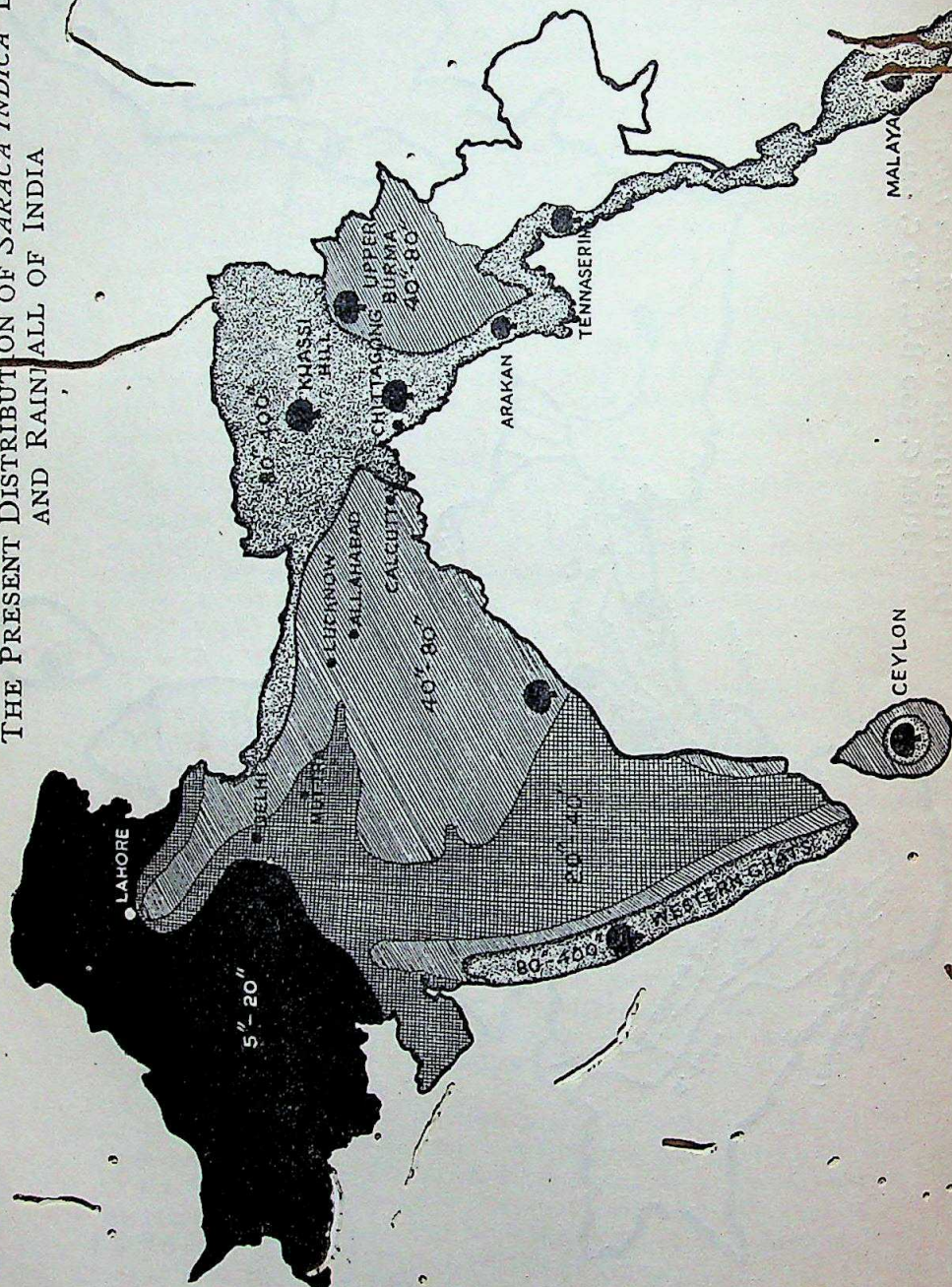
DISTRIBUTION OF *SARACA INDICA* L.N.  
FROM C. 500 B.C. TO C. 640 A.D.



Journ. Bombay Nat. Hist. Soc.

MAP II

THE PRESENT DISTRIBUTION OF *SARACA INDICA* LINN.  
AND RAINFALL OF INDIA



ling leaves' in the town of Alaka in the Himalaya, which was possibly in the outer Himalayas of Garhwal. The Asoka occurs at present in the lower elevations of the Himalayas eastwards of Kumaon. In the age of Kalidasa it was growing further north as far as outer-Garhwal above Hardwar.

In the celebration of seasonal festivals of spring in ancient India we find numerous references to the Asoka. There was a favorite festival celebrated in spring known as 'Asoka-pushpa-prachyika', gathering of Asoka flowers when young women collected them. Vatsayana, the celebrated author of *Kam Sutra*, the Hindu encyclopaedia of sex, probably lived at Ujjain in 4th century A.D. in the reign of the Guptas. In his description of popular festivities (Samasyakrida) he mentions seventeen seasonal festivals including an Asoka festival and a Kadamba festival, when people fought mock battles with ball-like Kadamba flowers. We find a description of worship of the Asoka tree at Kanauj during the celebration of the spring festival, Madan Utsav, in Harsha's Ratnavali which was written about 600-648 A.D. It is also mentioned that the citizens of Kanauj decked themselves with the Asoka flowers. Such activities are possible only if the Asoka trees were growing in abundance in these localities.

#### REMNANTS OF 'KADAMBA' FORESTS IN MATHURA.

Another reason which supports the presumption of the presence of Asoka forests in Kushana Mathura is that we still find remnants of Kadamba forests in the Mathura district. We find an unmistakable 'Kadamba' tree in one of the railing figures from Kanakali Tila. As compared with the 'Kadamba' tree the 'Asoka' was much more frequently sculptured by Kushan sculptors, and consequently it can be deduced that *Saraca indica* Linn. was a commoner tree than *Anthocephalus indicus* Rich., and very probably there were widespread forests of this tree. While the more moisture-loving *Saraca indica* has disappeared on account of increasing desiccation, the comparatively more drought-resistant *Anthocephalus indicus* has survived in some swampy pockets. Sir Digby Drake-Brockman, who compiled the Gazetteer of Mathura district, describing the vegetation writes: 'Many of the villages stand out devoid of trees; but near others, especially those of old standing, there are fairly large commons known as 'rakhya or kadamb' woods (Kadamb Khandi). The poorer specimens of these are merely uncultivated land covered with 'karil, 'pilu', 'hins' and other jungle shrubs; but in the better ones there are large 'kadambas' (*Anthocephalus cadamba*) and other fine jungle-trees which make these 'rakhyas' look like pieces of real forest. Many of these are of considerable size.'

These so-called 'kadamba rakhyas' or 'kadamba khandis' are barren waste-lands supporting only xerophytic shrubs and herbs used as pasture land by villagers. While the 'kadamba' trees have vanished, the name has lingered as a vestigia feature reminding one of the wet days of Mathura, when it was surrounded by luxuriant tropical evergreen forests. Mr. Babu Lal Gupta who has made a detailed study of the vegetation of the 'Brij' the Bharatpore-Agra-

Mathura area reports that Kadamba trees are still planted near some temples and along roadsides in Mathura. He also found a remnant of Kadamba forest in Keola Deo Jungle near Bharatpore. Some of these trees are as much as one hundred years old, and Mr. Gupta is of opinion that these are possibly the remnants of Kadamba forests on the verge of extinction.

The forest at Chhata, which is described in the Gazetteer as the largest Kadamba forest, contains very few Kadamba trees now and is mostly filled with Neem and Babul. In 'Kokila Ban' at Bathan almost all the Kadamba trees have disappeared in the last 30 years, and old inhabitants of Bathan say that about 30 years ago it was all a Kadamba forest. Large empty spaces have appeared in the Kadamba forest at Nandgaon as several Kadamba trees have died off. These observations of Mr. Gupta show that Kadamba trees in 'Brij' area are on the verge of extinction due to lack of sufficient moisture and this may mean the end of the ancient 'Kamyak Ban' of Mahabharata in the near future.

#### FROM EVER-GREEN TROPICAL FOREST TO DESERT.

The present vegetation of the 'Brij' country is xerophytic, and is not very different from that of the Rajputana desert. The average annual rainfall of Mathura is 23.61", which is the lowest in the United Provinces, and that of Agra is 25.1". After the close of the cold months, the temperature rises rapidly in the month of March, and humidity goes down. Night temperatures shooting upto 114° F. in the shade, and desiccating hot west winds from the rocky Aravalli hills and sandy deserts of Rajputana, often accompanied by dust-storms in May and June have produced a typical desert vegetation of xerophytes, with adaptations against dry conditions and with devices for conserving moisture. The commonest trees are the leafless Karils (*Capparis aphylla* Roth.), the ungraceful pilu (*Salvadora oleoides* Dene.), with tough leathery leaves, the ubiquitous Babul (*Acacia arabica* Wild.), the feathery-leaved Chonkar (*Prosopis spicigera* Linn.), the Hingot (*Balanites aegyptiaca* Delile), Pansendu (*Diospyros cordifolia*), Pilkhan (*Ficus cordifolia*) and several species of *Tamarix* with reduced scaly leaves. The waste spaces between the villages are more or less bare with occasional patches of Jharber (*Zizyphus rotundifolia* Lamk.), *Salvadora persica* Linn., and Dhak (*Butea frondosa*). The rocky areas are covered with hardy shrubs like Dho (*Anogeissus parviflora*). Among the herbaceous vegetation we find such interesting xerophytes such as Kheep (*Leptadenia spartium* Wight) with erect cylindrical almost leafless branches, the spiny Jawasa (*Alhagi camelorum* Fisch.), and the deep-rooted Ratanjot (*Arnebia hispidissima* DC.). In the shade of the prickly bushes of *Capparis sepiaria* Linn. grows the inconspicuous drought-resistant Gillirgitta (*Ceropegia bulbosa* Roxb.)

The 'Brij' country which was covered with luxuriant evergreen tropical forests of *Baraca indica*, *Mesua ferrea* and *Anthocephalus indicus* about 2,000 years ago has completely changed now. The jungles which were the abode of the rhinoceros and the wild elephant, have disappeared, and in their place we find sandy

wastes haunted by flocks of black back and chinkara deluded by mirages of rivers and lakes which exist no more. The ponds and lakes which were filled with pink and white lotuses and visited by ducks and wild geese providing inspiration to the Kushana sculpture, have completely disappeared, and in their place we see ravines, sand dunes and parched plains which have become the rendezvous of the Grey Partridge (*Francolinus pondicerianus* Gmelin.), quail (*Coturnix coturnix* Linn.) and the sand-grouse (*Pterocles exustus* Temm. and Lang.) the typical birds of the Rajputana desert.

I acknowledge with thanks the help, I have received from Dr. V. S. Agarwala, Curator Provincial Museum, Lucknow, in various ways. I am also grateful to Mr. Babu Lal Gupta of Agra College, Agra, for making use of his valuable observations on the vegetation of 'Brijj' area, to Dr. A. C. Joshi of Hindu University, Benares, for the benefit of his views, and to Dr. K. Biswas, Superintendent, Royal Botanic Garden, Calcutta, for so kindly sending information about the distribution of trees discussed in this paper and supplying preserved specimens for comparison.

## EXPLANATION OF PLATE.

*Mathura Sculptures of Kushan Period.*

- Fig. 1.—A woman under a Kadamba tree (*Anthocephalus indicus* Rich.)  
 Fig. 2.—A woman under an Asoka tree (*Saraca indica* Linn.)  
 Fig. 3.—A woman under a Nag-kesar tree (*Mesua ferrea* Linn.)  
 Fig. 4.—A woman under a Champak tree (*Michelia champaca* Linn.)  
 Fig. 5.—A sculptured fragment showing leaves and flowers of *Saraca indica* Linn.

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LIFE-HISTORY AND BIONOMICS OF TWO PREDACEOUS  
AND ONE MYCOPHAGOUS SPECIES OF  
*COCCINELLIDAE*.

BY

S. R. BAGAL, M.SC.

*Entomological Officer, Agricultural Research Station, Padegaon.*

AND

DR. K. N. TREHAN, M.SC., PH.D. (London)

*Agricultural Entomologist to Government, Bombay.  
Entomological Laboratory, College of Agriculture, Poona.*

(With a plate)

INTRODUCTORY.

Ladybird beetles may be harmful or beneficial, the former being the reputed pests of certain crops and vegetables, while the latter include predaceous as well as mycophagous species. With the recent development of biological control of insect pests the study of predaceous species has achieved considerable importance. The first successful experiment of this nature, was carried out in California in 1889 to control cottony cushion scale, *Icerya purchasi* through the agency of a ladybird beetle, *Rodolia cardinalis* Muls. from Australia. This enterprise served as a stimulus to applied entomology in the field of biological control. Since the application of predators under field conditions, needs a thorough knowledge of their bionomics and seasonal activities, the present investigations were taken up with a view to studying in detail some of the important species of this province, namely (1) *Chilomenes sexmaculata* Fabr. (2) *Coccinella septempunctata* L. and (3) *Thea cincta* Fabr. Their life-history, morphological characters and habits etc., are described below:—

HISTORICAL.

Mulsant (1866), Crotch (1873), and Gorham (1894), contributed valuable information on the systematics and distribution of various

species of coccinellids. Stebbing (1903) published an account of 16 predaceous species from India and included them in 11 genera. His descriptions include generic characters, life histories of some of the species, feeding habits, distribution as well as description of the adults of *Coccinella septempunctata* and *Chilomenes sexmaculata*. Lefroy (1906) gave the broad characters of the family Coccinellidae and briefly described some of the species, with short notes on the colouration of the larvae and adults of *Coccinella septempunctata*, and *Thea cincta* and the life-history of *Chilomenes sexmaculata*. Clausen (1915) added notes on the life-histories, and other biological features of about ten different species except the ones selected for this study. Tullgren (1916) recorded for the first time *Perilitus terminatus*, a parasite of the larva of *Coccinella septempunctata*. Subramanyam (1923) published a list of 38 species and briefly described the adults, feeding habits, distribution and life-histories of a few species, and colour variation in *Chilomenes sexmaculata*. He also described briefly the immature stages of *Thea cincta* and three distinct types of adults in *Chilomenes sexmaculata*. Dobrzhansky (1926) added valuable notes on the systematic position of some genera of Coccinellidae on the basis of their genitalia and also studied *Coccinella septempunctata* in this respect, whereas Strouhal (1927) has brought out some structural variations in the mandibles of *Epilachninae*, *Coccinellinae*, and *Psylloborini* as diagnostic characters. Pradhan (1935) contributed on the study of genitalia in *Epilachna indica* and referred to the male genital tube of *Chilomenes sexmaculata* while Volkov (1937) added information on the food of *Coccinella septempunctata* feeding on two species of moths recorded on cotton.

#### TECHNIQUE.

The material was collected from various crops at the Agricultural College Farm, Poona. For laboratory observations however, rearing was managed in glass jars or tubes of 3" x 1" with muslin tied at the open end. The mycophagous larvae could be reared successfully upto the third instar in similar jars simply by providing small pieces of leaves infested with fungus.

Feeding habits were studied under controlled experiments. The beetles, however, were given more aphids than was actually needed. The first and second stage larvae were fed on young nymphs.

For the study of the mouth parts, specimens were treated in 10 per cent. KOH solution and boiled for about ten minutes. The mouth parts were dissected out, washed in fresh water and preserved in 70% alcohol. The larvae of the first two instars were treated in the same way, but the grown up larvae and the pupae were punctured before treating them with KOH and were kept over night for penetration. The copulating adults were killed instantaneously with chloroform, and treated similarly for further studies. For the study of digestive system, the material was fixed in Carnoy's fluid, white for other systems Allan's modifica-

tion of Bouin's fluid and corrosive sublimate were used. Acid fuchsin proved a useful stain for general purposes, but double staining with Delafield's haematoxylin and eosin was rather more effective. Sketches were made with a Camera Lucida.

## DESCRIPTION OF STAGES.

*Chilomenes sexmaculata*.—Egg.—Smooth, cigar-shaped, standing erect deep yellow when fresh, light yellow when about to hatch. Average measurements 1.0 mm. x 0.45 mm. micropyles 26 to 30 arranged in a circle at the free end.

*1st Instar Larva*.—Yellowish-white when newly hatched, turns to grey subsequently, average measurements 1.65 mm. x 0.46 mm. faint coloured patches on the body; compound spines distinct, bristles variable; head broader posteriorly, bristles 15 pairs, ocelli three, antennae two joined. Prothorax transversely oval, margins rimmed, beset with 8-10 bristles on each side, a compound, well developed spine laterally and a smaller one on each side near the mid-dorsal line and near the posterior edge. The meso- and metathorax have two dorso-lateral compound spines and two smaller ones in the middle of each segment. Each abdominal segment except the last, provided with six compound spines—two median, two dorso-lateral and two lateral, these constitute six longitudinal rows of compound spines; bristles variable in different regions, terminal portion tubular, anal-foot fleshy, broader at the free end and provided with a sucker.

*2nd Instar Larva*.—Average measurements 2.62 x 0.62 mm.; head 0.34 x 0.48 mm. shining black, compound spines and bristles as in the previous instar, dorsal spines on the fourth and the dorso-lateral spines on the first abdominal segments, white.

*3rd Instar Larva*.—Average measurements 4.24 x 0.97 mm.; head 0.45 x 0.61 mm. colour deep black, spines as in previous instar.

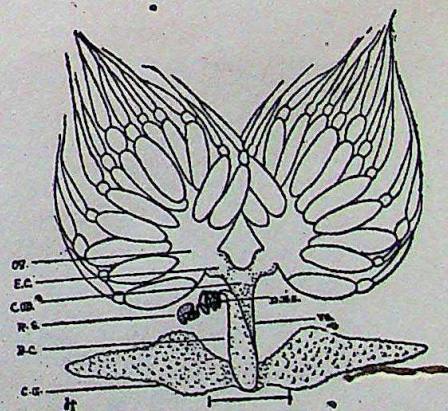
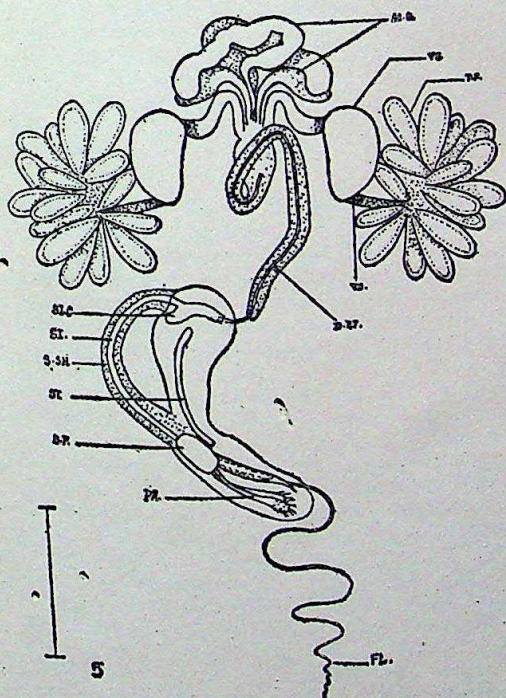
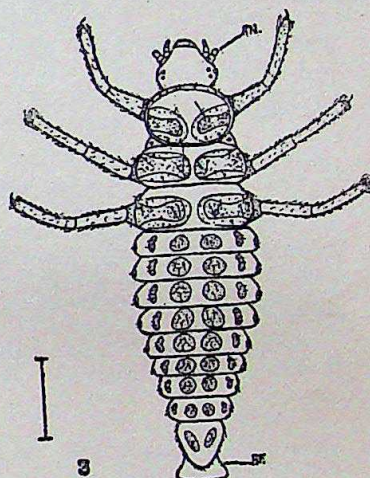
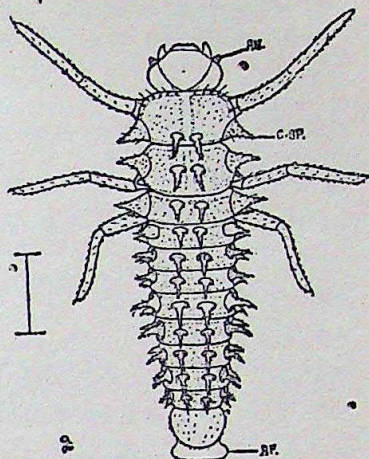
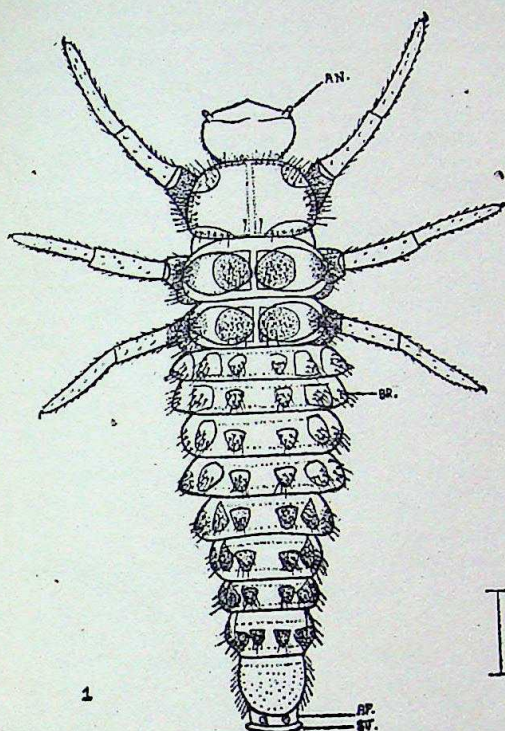
*4th Instar Larva*.—(Pl. 1. Fig. 2). Average measurements 7.10 x 0.97 mm.; thin white band at the anterior margin of prothorax, white patches between the median pairs of spines and especially between those on the thoracic segments, head brown anteriorly, black posteriorly, legs longish in appearance.

*Pupa*.—Average measurements 3.65 x 2.65 mm.; oval from above, irregular posteriorly, whitish-yellow with black markings; prothorax deflexed, anterior portion rimmed ventrally, spotted with black posteriorly; elytra visible within sacs; mesothorax with two semicircular black marks, one on each side, posterior edge with a thick oblique black band; metathorax with similar black markings; second to sixth abdominal segments with a pair of pyramidal black marks, one on each side of the mid-dorsal line.

*Adult*.—Three types—only colour variations, oval, convex above, measurements vary from 3.99 mm. to 5.5 mm.; males smaller than the females, head yellowish-white anteriorly, black posteriorly, 0.88-1.05 mm. in length and 1.00-1.36 mm. in breadth; eyes black, bean-shaped, relatively larger in males; antennae clavate, eleven segmented, 0.44-0.58 mm. long, club three or four jointed; mouth parts modified into chewing and biting type, prostheca present, mandibles bifid at the apex, with a basal tooth; prothorax yellow, orange or orange-red with a black spot in the middle, 0.85 to 1.16 mm. long, 2.00-2.55 mm. broad, concave anteriorly, lateral margins deflected. Elytra yellow, orange or orange-red each with two transverse zigzag dark bands, 0.1 mm. broad, and a black oval spot near the apical angle, on an average 3.12 mm. in male, 3.81 mm. in female. Legs retractile, tibia with two spurs at the distal end, the tarsus four jointed, first two segments pubescent, the third flat in male with hinder margin notched, triangular in female, a portion of the pygidium visible in male.

*Coccinella septempunctata*.—Egg.—Smooth, cigar-shaped, standing erect, deep yellow, measures on an average, 1.29 mm. x 0.53 mm. micropyles 30, arranged in a circle at the free end.

*1st Instar larva*.—Black with darker patches—Dorsally two on each thoracic segment and laterally two on 2nd and 3rd thoracic segments; six patches on each abdominal segment—two medium, two dorso-lateral and two lateral, ave-



Life-history and Bionomics of predaceous and mycophagous Coccinellidae.  
For explanation see end of article.



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rage measurements 1.88 mm. x 0.50 mm., head with 18 pairs of bristles, antenna two jointed, prothorax 15-18 pairs, distributed around rim, meso- and meta-thorax with nine pairs, 2-5 bristles laterally, three prominent bristles on each abdominal segment at the region of the patches. Ventrally the larva possesses protuberances distributed in the thoracic and abdominal region.

*2nd Instar larva.*—Black, average measurements 3.43 mm. x 0.81 mm. patches as in the previous instar, dorso-lateral and laterals on the first abdominal segment transformed into orange, and dorso-lateral sides of the prothorax develop warts; number of bristles on each segment increased by 3-5 smaller ones, ventral protuberances developed into bristles and distributed as in previous instar.

*3rd Instar larva.*—Average measurements 5.02 mm. x 1.28 mm. dorso-lateral and lateral patches on the first abdominal segment deep orange and similar ones on the fourth abdominal segment, bristles on prothorax and warts on all the abdominal segments prominent, ventral groups of bristles as in the previous instars.

*4th Instar larva.*—(Pl. 1, Fig 1). Average measurements 11.95 mm. x 2.52 mm. when full grown; head yellow; four orange patches on prothorax, orange coloured dorso-lateral and lateral patches on the first and fourth abdominal segments, warts well developed, ventral bristles conspicuous, rest as in other instars.

*Pupa.*—Shape similar to the previous example, average measurements 5.67 mm. x 3.83 mm., deep yellow when fresh, subsequently develops black markings, a pair of orange spots on the first abdominal segment and two pairs on the fourth. Eyes prominent; prothorax yellow with two pairs of black dots; mesothorax and metathorax with one pair each; elytra extending to the first two abdominal segments, decorated with three black dots; second to the sixth abdominal segments each with a pair of median and dorso-lateral patches, spiracles distinct.

*Adult.*—Measurements vary from 5.55-7.27 mm., males relatively smaller in size, oval, convex above; head black, broader posteriorly, mouth parts as in the previous species, white spots near the eyes, each measures 1.27 mm., x 1.62 mm., antennae eleven segmented, 0.88 mm. long, scape the longest, terminal segment the broadest; prothorax deep black with two quadrangular white patches on the anterior angles, more than twice as broad as long, measures 1.34 mm. x 3.14 mm. Proximal tarsal joints pubescent, tibia with two spurs at the distal end; elytra yellow, orange or orange-red, each with three black circular spots longer than broad, average measurements 5.32 mm. x 5.03 mm. The last sternum triangular in female, the anal margin notched in the male.

*Thea cincta*—*Egg.*—Cigar-shaped, creamy white, chorion sculptured, average measurements 1.04 mm. x 0.4 mm., micropyles 30 in a circle at the free end.

*1st Instar larva.*—Yellow dorsally, ventral surface white, average measurements 1.61 mm. x 0.38 mm., head with black spots and 18 pairs of bristles, ocelli three, antenna three jointed, prothorax rimmed, bloched, bristles 10-12 pairs, abdominal blotches each beset with three bristles.

*2nd Instar larva.*—Same as in the previous instar, average measurements 2.85 mm. x 0.59 mm.

*3rd Instar larva.*—Practically similar to that of the previous instar, average measurements 3.68 mm. x 0.91 mm., prothoracic bloches not complete.

*4th Instar larva.*—(Pl. 1, Fig. 3). Thorax deep yellow, bloches divided, abdomen banded. Measurements 4.95-6.63 mm. long and 1.44-1.88 mm. broad.

*Pupa.*—Deep yellow, average measurements 4.08 mm. x 2.75 mm. prothorax rimmed, white, mesothorax slightly depressed in the middle, two black spots; faint black patches on 1-4th abdominal segments, elytra do not meet in the middle.

*Adult.*—Measurements 4.0 to 4.8 mm. long, males relatively smaller than the females, head yellow, broader than long, measures 0.45 mm. x 1.14 mm.; eyes bean-shaped, relatively bigger in male; mandibles bifid apically, tips dentate antennae eleven segmented, 1.22 mm. long, scape the longest, terminal segment the broadest, last but two segments serrate, prothorax concave anteriorly, curved laterally, broader than twice its length, measurements 0.86 mm. x 2.18 mm., yellowish with two black spots; elytra yellow, rimmed, average measurements 3.52 mm. x 3.42 mm., legs long, yellow, claws each with a basal tooth; last sternum as in the previous example.

## FOOD

The predaceous species feed on aphids which have been recorded from the following plants :—

Serial No.	Common English name.	Botanical Name.	Family
1.	Safflower	<i>Carthamus tinctorius</i> , L.	Compositae.
2.	Cabbage	<i>Brassica oleracea</i>	Cruciferae.
3.	Knolkhol	" sp.	"
4.	Turnip	" <i>campestris</i> , L.	"
5.	Radish	<i>Raphanus sativas</i> , L.	"
6.	Tondli	<i>Coccinia indica</i> , W. & A.	Cucurbitaceae
7.*	Jowar	<i>Andropogon sorgham</i> , Brot.	Gramineae.
8.	Cluster bean	<i>Cyamopsis psoralioides</i> , Dc.	Leguminosae.
9.	Lentil ...	<i>Lens esculentas</i> , Moench	"
10.*	Lucerne	<i>Medicago sativa</i> , Linn.	"
11.	Pea	<i>Pisum sativum</i> , L.	"
12.	Linsced	<i>Linum usitatissimum</i> , L.	Linaceae.
13.*	Cotton	<i>Gossypium</i> spp.	Mulaceae.
14.	Lady's finger	<i>Hibiscus esculentus</i> , L.	"
15.*	Mosambi	<i>Citrus</i> spp.	Rutaceae
16.*	Brinjal	<i>Solanum melongena</i> , L.	Solanaceae.
17.	Chilly	<i>Capsicum annum</i> , L.	"
18.	Potato	<i>Solanum tuberosum</i> , L.	"
19*	Tobacco	<i>Nicotiana tabacum</i> , L.	"

N.B.—1. \* The plants recorded by the previous workers, others are recorded by us which may probably be new ones.

2. The predaceous species have also been recorded on the following plants:

(1) Mountain spinach, (2) A spider wort, (3) Bur weed. (4) Chrysanthemum, (5) *Coreopsis aristosa*, (6) a knot grass, (7) *Petunia* and (8) Dill.

## LIFE HISTORY.

**Oviposition.**—Copulation may take place throughout the day. This, however, is not in conformity with Pradhan (1934-35). First copulation after emergence usually takes longer and may last upto two hours. Eggs are generally laid in batches on the under surface of leaves. Copulation as well as oviposition are continued during the life of the adults and sometimes parthenogenetic eggs may also be laid which are usually scattered and do not hatch. In *Chilomenes scammulata* Fabr. eggs in each batch are laid in 2-3 rows and in 2 months and 9 days. Pre-oviposition period ranges from 2-4 days. *Coccinella septempunctata* L. lays in irregular batches with a maximum of 82 eggs recorded so far in a batch. Pre-oviposition period varies from 4-5 days during monsoon and 7-10 days during winter. The maximum number of eggs laid by a female was 3,765 in 2 months and 21 days. Eggs of *Thea cincta* Fabr. are also laid in rows and the maximum number recorded in a batch was 28.

**Incubation period.**—The incubation period is about three days during monsoon when the temperature ranges from 68.0 to 90° F. During winter, however, with the fall in temperature this period extends to four days. Normally hatching is cent per cent but the newly hatched grubs may devour the unhatched eggs. The egg hatches by a vertical slit at its free end. The larva rests over the egg shell and commences free movements after about 3-6 hours.

<sup>1</sup> In *Epilachna 28-punctata*—a purely phytophagous—form the mandibles, are broad at the base, concave laterally, serrate, basal tooth wanting.

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Eggs hatch even when immersed in water but not at a low temperature of 10° F.

**Larval stage.**—There are 4 instars and the total duration varied from 4.6 days to 14.7 days in all the three species. In *Chilomenes sexmaculata* Fabr. it was 4.6 days during July and August and 14.7 days during November and December. In *Coccinella septempunctata* L. the duration was 9.16 days during October and 11.15 days during January and February, and that of *Thea cincta* Fabr. 11.29 days and 12.56 days during July and November-December respectively.

**Pupal stage.**—Fullgrown larva attaches itself by the hinder end and transforms into a pupa. The pupal stage on an average, extended from 3 to 5.7 days.

**Life-cycle**—(Table I).—The duration of life-cycle varies from 11-23 days according to the season. The shortest duration was noticed during April and May when the temperature varied from 78° F. to 98° F. During December and January, however, with the fall in the temperature, the duration of life-cycle extended to 23 days. During August 1938 to June 1939 fifteen generations of the predaceous species were reared under laboratory conditions but it has been estimated that about twenty generations may pass during one year.

The average life-cycle of *Chilomenes sexmaculata* Fabr. during monsoon when the maximum and minimum temperatures ranged between 75 to 90° F. and 68-78° F. respectively, was 10.6 days, but it extended to about 22.9 days during winter when the temperatures were comparatively lower. The life-cycle of *Coccinella septempunctata* L. was on an average 16.2 days during the month of October and 18.8 days during January and February while that of *Thea cincta* Fabr. was 17.3 days in July and 20.4 days during November and December. The duration during the month of July however, was very much prolonged as compared with other species.

**Longevity of adults.**—The beetles are long lived and under laboratory conditions the adults of *Chilomenes sexmaculata*, *Coccinella septempunctata* and *Thea cincta* could survive for about four months, five months and three months respectively. The females when kept alone lived for a relatively longer period.

**Habits.**—The adults are usually found on the under-surface of leaves. They feign death when disturbed and exude a viscid liquid. This liquid is yellow or amber in colour in the predaceous species and whitish with a tinge of yellow in the mycophagous species.

## SEASONAL HISTORY.

In nature *Chilomenes sexmaculata* Fabr. always outnumbers *Coccinella septempunctata* L. in spite of its relatively lower fecundity. From June to February both the species are found on various crops infested by aphids but during summer they are mostly found on lucerne. *Thea cincta* Fabr. on the other hand, found in plentiful on cluster beans and lady's finger during monsoon and on *Coccinia indica* during winter. During hot weather however, adults of *Chilomenes sexmaculata* Fabr., and *Coccinella septempunctata* L. were also found feeding on young nymphs of *Pundaluoya simplicia*, on jowar shoots. It has been observed that *Coccinella septempunctata*, L. and *Chilomenes sexmaculata* Fabr. are found almost in association with each other, and the females generally predominate in numbers (Table II). The two predaceous species are active throughout the year whereas *Thea cincta* Fabr. is not met with during summer. Of all these beetles *Coccinella septempunctata* L. may live upto 41 days without food, but *Thea cincta* Fabr. could not survive for more than four days under such conditions. Under low temperatures however, the adults of *Chilomenes sexmaculata* died after 7 days at 20° F while those at 42° F lost their activity and entered hibernation much earlier. At 50° F the insects showed some activity even after a week.

## ECONOMIC IMPORTANCE.

The adults of the predaceous species are more important than their larvae. Lefroy (1906) remarks that a single larva of *Chilomenes sexmaculata* Fabr. consumes about 2,400 aphids during its life-time. This is contrary to our observations because the maximum number of aphids that a single larva could consume during its larval period was 303 in *Chilomenes sexmaculata* and 420 in *Coccinella septempunctata*. The feeding capacity increases with the age.

The adults, however, are great feeders. The maximum number of aphids consumed by a pair of *Chilomenes sexmaculata*, was 16,321 and of *Coccinella septempunctata*, 22,574, during their life, with an average of 60.84 and 106.29 per adult per day respectively.

According to Fernald (1936) about 30,000 adults of *Hippodamia convergens* proved effective over an area of 10 acres, while Dutt (1927) concluded that 3,000 ladybird beetles were enough to control the aphids within fifteen days, in an area of 1,200 sq. feet.

Our observations under controlled conditions yielded that 75 adults of *Chilomenes sexmaculata* could destroy practically all aphids from five cabbage plants which were severely infested with them. With these encouraging results it may be presumed that satisfactory biological control may be achieved through the application of these beetles.

#### INTERNAL ANATOMY.

*Alimentary system.*—*Chilomenes sexmaculata* Fabr. Paired pouches anterior to proventriculus and gastric coeca as observed by Landis (1936) in *Ceratomegilla fuscilabris* Muls. are not present, enteric coeca prominent, salivary glands wanting; malpighian tubes six in number.

#### REPRODUCTIVE SYSTEM<sup>1</sup>.

##### Female.—

*Chilomenes sexmaculata* Fabr. (Pl. 1, Fig. 4).—Two ovaries, each consisting of 20 ovarian tubules, oviducts, vagina, bursa copulatrix and the receptaculum seminis. Each oviduct measures 0.55 mm., bursa copulatrix stands dorsally on the vagina having its anterior end tapering and somewhat tilted towards the left side on the 4th sternite; receptaculum seminis small, curved, chitinous sac. There is a small accessory gland for the receptaculum seminis. A pair of collecterial glands open laterally in the vagina.

*Coccinella septempunctata* L.—Each ovary consists of fifty ovarioles. The receptaculum seminis is attached to the bursa copulatrix by a small, slender duct known as the ductus receptaculi that passes through a funnel-shaped dilatation of the infundibulum. The major part of the infundibulum remains within the bursa copulatrix, and its free pointed end is called the cornu. The distal end of the bursa copulatrix does not taper.

*Thea cincta* Fabr. Each ovary consists of twenty ovarioles; receptaculum seminis relatively small and ringed, attachment to the bursa copulatrix by a small narrow duct.

##### Male.—

*Chilomenes sexmaculata* Fabr. (Pl. I, Fig. 5).—A pair of testes, vasa deferentia, vesiculae seminales, ductus ejaculatorius, two pairs of accessory glands and the copulatory organs. Each testis looks like a bunch of grapes of twenty testicular follicles.

The external genitalia consists of a siphon, the penis, basal plates, a trabe and two paramera. The intramittant organ is the siphon and the covering tube is the penis (Siphonal sheath of Pradhan). Siphonal capsule is strongly chitinized, boot-shaped, the distal part of the penis is fused with the basal plates, strongly pointed and slightly curved. Paramera hairy at distal ends, 0.55 mm. long; trabe (strut) rod-like, broader distally.

*Coccinella septempunctata* L.—Almost similar to that in the previous species but each testis has fifty testicular follicles; accessory glands very long and coiled.

*Thea cincta* Fabr.—Testicular follicles twenty, ejaculatory duct long; accessory glands very long and coiled. The paramera longer than those in other two species. The distal end of the siphon is spoon-shaped and bears tender hair-like structures.

<sup>1</sup> 1. Nomenclature after T. H. Dobrzhansky.

2. Not described in detail in all the species—only differences are given.

## LIFE-HISTORY AND BIONOMICS OF COCCINELLIDAE 573

## SUMMARY.

The life-history of the two predaceous and one mycophagus species namely *Chilomenes sexmaculata* Fabr., *Coccinella septempunctata* L. and *Thea cincta*, Fabr. respectively is described. Eggs are generally laid in batches on the underside of leaves and hatch within 3-4 days. The maximum number of eggs laid by a female of the first two species, was 2384 and 3765 respectively. The larval stage on an average, varied from 4.6 days to 14.7 days and the pupal stage from 3 to 5.7 days. The duration of life-cycle varied from 11 to 23 days, according to the season. About twenty generations have been estimated during the course of a year. The various stages of the insects, their habits and seasonal activities are described. Of the predaceous species the adults have been found more important from the economic point of view than their larvae. The alimentary system of *Chilomenes sexmaculata* Fabr. and the differences in reproductive systems of all the three species are also discussed.

TABLE I

Life-history of all the three species during 1937-39

Species	Months	Average duration of egg stage	Average duration of larval stage (days)				Total larval stage (day's average)	Average pupal stage (Days)	Total duration of life-cycle.
			I	II	III	IV			
<i>Chilomenes sexmaculata</i> Fabr. ...	1937								
	July-Aug. ...	3.0	1.1	1.0	1.1	1.4	4.6	3.0	10.6
	Nov.-Dec. ...	3.0	3.8	2.0	2.0	4.2	12.0	5.8	20.7
	December ...	4.0	4.7	2.6	3.5	3.9	14.7	4.2	22.9
	July ...	2.5	1.6	1.0	1.2	2.2	6.0	2.8	10.8
	Oct.-Nov. ...	3.0	2.8	2.6	2.0	4.4	11.8	5.0	19.8
" "	1939								
	Jan.-Feb. ...	3.0	2.3	2.3	2.5	4.8	12.6	3.0	18.0
<i>Coccinella septempunctata</i> L. ...	1938								
	Jan.-Feb. ...	3.0	3.0	1.8	1.9	4.0	10.8	5.0	18.8
	October ...	3.0	2.0	1.0	2.7	3.5	9.2	4.0	16.2
" "	1939								
	Jan.-Feb. ...	3.0	2.8	1.2	2.7	4.8	11.5	4.0	18.5
<i>Thea cincta</i> Fabr. ...	1938								
	Nov.-Dec. ...	3.0	2.6	2.0	2.4	5.6	12.6	4.9	20.4
" "	1939								
	July ...	3.0	2.6	2.4	2.5	4.0	11.3	3.5	17.3

TABLE II  
Sex proportion in all the three species during 1938-39

Species	1938												1939											
	June		July		August		September		October		November		December		January		February		March		April		May	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	
<i>Chilomenes sexmaculata</i> Fabr. ...	50.0	50.0	27.3	72.7	41.2	58.8	60.0	40.0	46.5	53.5	41.7	58.3	31.0	69.0	42.9	57.1	35.9	64.1	37.5	62.5	44.5	55.5	36.6	63.4
<i>Coccinella septempunctata</i> L. ...	...	...	40.0	60.0	...	...	50.0	50.0	37.5	62.5	33.3	66.7	47.1	52.9	58.6	41.4	53.6	46.4	...	...	58.3	41.7	44.5	55.5
<i>Thea cincta</i> Fabr. ...	37.2	62.9	44.1	55.9	51.0	49.0	46.7	53.3	33.4	66.6	26.1	73.9	48.4	51.6	60.0	40.0	46.3	53.7	30.0	70.0	66.7	33.3	...	...

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## ABBREVIATIONS USED.

AC.G.	...	Accessory glands.
A.F.	...	Anal foot.
AN.	...	Antenna.
B.C.	...	Bursa copulatrix.
B.P.	...	Basal plate.
BR.	...	Bristle.
C.G.	...	Colleterial glands.
C.OD.	...	Common oviduct.
C.SP.	...	Compound spine.
D.EJ.	...	Ductus ejaculatorius.
D.R.S.	...	Duct of the receptaculum seminis.
E.C.	...	Egg calyx.
FL.	...	Flagellum.
OV.	...	Ovary.
PA.	...	Perameron.
R.S.	...	Receptaculum seminis.
SI.	...	Sipho.
SI.C.	...	Siphonal capsule.
S <sub>2</sub> SH.	...	Siphonal sheath.
ST.	...	Strut.
SU.	...	Sucker.
T.F.	...	Testicular follicle.
VG.	...	Vagina.
VS.	...	Vesicula seminalis.

## EXPLANATION OF THE PLATE.

- Fig. 1.—Fourth instar larva of *Coccinella septempunctata*. L.  
 Fig. 2.—Fourth instar larva of *Chilomenes sexmaculata*. F.  
 Fig. 3.—Fourth instar larva of *Thea cincta*. F.  
 Fig. 4.—Female reproductive system of *Chilomenes sexmaculata*. F.  
 Fig. 5.—Male reproductive system of *Chilomenes sexmaculata*. F.

## THE MEDICINAL AND POISONOUS STERCULIADS OF INDIA.

• BY

J. F. CAIUS, S.J., F.L.S. (Deceased)

The STERCULIACEÆ are herbs, shrubs or trees, sometimes lianes, which belong to tropical and subtropical regions. There are 660 species, distributed into 48 genera.

They contain an abundant mucilage, combined in the old bark of the woody species with a bitter astringent extractable matter, and exhibit stimulant and emetic properties. Many yield gums which in their appearance resemble tragacanth, and are reputed tonic. The fruit is often astringent and antidysenteric. The seeds may be diuretic and have a stimulating effect on the central nervous system.

Among the products isolated we may mention :—(1) *glucosides*—kolatin—; (2) *tannins*—kolatannin—; (3) *gums*; (4) *alkaloids*—caffeine, theobromine—; (5) *acids*—tartaric—; (6) *amino-acids*—asparagin—; (7) *fats* and *carbohydrates*.

The medicinal and poisonous Sterculiads of the world belong to 23 genera :—ABROMA (tropical Asia to Australia); BUETTNERIA (tropical); COLA (Africa); DOMBEYA (Africa, Madagascar); ERIOLAENA (Indomalayan); FREMONTIA (California); GUAZUMA (tropical America); HELICTERES (tropics, except Africa); HERMANNIA (tropical and subtropical, chiefly Africa); KLEINHOVIA (tropical Asia); LEPTONYCHIA (tropical Africa and Asia); MAHERNIA (Africa); MELOCHIA (tropical); MYRODIA (tropical); PENTAPETES (Indomalayan); PTEROCYMBIUM (Burma, Malaya); PTEROSPERMUM (tropical Asia); PTERYGOTA (tropical); SCAPHIUM (Burma, Malaya, Borneo); STERCULIA (tropical); TARRIETIA (Eastern Asia, Australia); THEOBROMA (tropical America); WALTHERIA (tropical America).

The medicinal and poisonous Sterculiads of India belong to 16 genera :—ABROMA, BUETTNERIA, ERIOLAENA, GUAZUMA, HELICTERES, KLEINHOVIA, MELOCHIA, PENTAPETES, PTEROCYMBIUM, PTEROSPERMUM, PTERYGOTA, SCAPHIUM, STERCULIA, TARRIETIA, THEOBROMA, WALTHERIA.

- A. Flowers unisexual; petals none; stamen-column with anthers on the apex, clustered or in a ring.
  - I. Ovarian cells 1-ovuled; fruit of thick samaras with foliate wings ... TARRIETIA.
  - II. Ovary with 2 or more ovules in each cell; fruit dehiscent
    - 1. Radicle remote from the hilum. Follicles coriaceous or woody ... STERCULIA.
    - 2. Radicle next the hilum.
      - a. Follicles woody. Seeds many, winged at the apex, albuminous ... PTERYGOTA.

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- b. Follicles membranous, opening long before maturity.
  - i. Calyx small, lobes lanceolate; follicles very large, green, one seed at base of each ... .. SCAPHIUM.
  - ii. Calyx campanulate; 2 seeds in each follicle ... .. PTEROCYMBIUM.
- B. Flowers bisexual.
  - I. Petals deciduous; stamen-column bearing a cup edged with anthers and staminodes, 5 to 15.
    - 1. Shrub; flowers pink, capsule membranous inflated ... .. KLEINHOVIA.
    - 2. Shrub; flowers purple or white; capsule woody not inflated; seed not winged ... .. HELICTERES.
    - 3. Trees; flowers large, white; capsule woody, large; seed winged ... .. PTEROSPERMUM.
  - II. Petals deciduous; stamen-column tubular, conical, antheriferous for nearly its whole length; staminodes none. Capsule ovoid, woody or coriaceous ... .. ERIOLAENA.
  - III. Petals persistent; anthers 10 to 20 on the tip of a cup on the column. Bracteoles caducous. Herb; petals red ... .. PENTAPETES.
  - IV. Petals marcescent, flat. Stamen column tubular at the base only; stamens 5; staminodes none.
    - 1. Shrubby herb or shrub; capsule 5-celled; flowers pinkish ... .. MELOCHIA.
    - 2. Shrubby; capsule 1-celled, 1-seeded; flowers yellow ... .. WALTHERIA.
  - V. Petals concave at the base; stamen-column tubular; anthers marginal, solitary or in groups between the staminodes.
    - 1. Fertile stamens 5 opposite the sepals ... .. THEOBROMA.
    - 2. Stamens uniseriate.
      - a. Anthers solitary between each staminode. Petals clawed with 2 lateral lobes and a long appendage. Climber ... .. BUETTNERIA.
      - b. Anthers 2-4 between each staminode.
        - i. Petals with a stipitate ovate blade. Capsule turbinate, membranous ... .. ABROMA.
        - ii. Petals with a linear bifid blade. Capsule oblong, woody, tubercled. Flowers yellow ... .. GUAZUMA.

## ABROMA.

The genus consists of 10 species spread over tropical Asia and distributed to Australia.

*A. angusta* Linn. *fil.* is used medicinally in Indo-China and in the Philippine Islands. In the latter country *A. alata* Blanco is also credited with therapeutic properties.

**Abroma augusta** Linn. *fil.* is found indigenous or cultivated throughout the hotter parts of India, Java, the Philippine Islands, and China.

In Lakhimpur, Assam, the bark is used for sores. A part of the root is used internally and externally by the Santals to cure abscess.

The root bark has long been used in Bengal as an emmenagogue. As far back as 1873, Thornton wrote in the *American Journal of Medical Science* (p. 276): 'The fresh viscid juice of the root-bark is useful in the congestive and neuralgic varieties of dysmenorrhoea; it regulates the menstrual flow and acts as an uterine tonic.'

In the *Indian Medical Gazette* of May 1900, Sircar reported as follows:—

'Forty years ago I first came to know the medicinal properties of this indigenous plant as a good emmenagogue in menstrual disorders. . . . The official part of the plant is the fresh viscid sap, which abounds in the thick easily separable bark of the root and is insoluble in water. . . . Attempts have been made to administer the drug in the more acceptable forms of tincture, pill or powder, but none prove so efficacious as the fresh viscid sap in substance, in which form I have used it with wonderful results.'

On analysis, Chopra, Ghosh and Chatterjee obtained from the root-bark a mixed oil, resins, an alkaloid—in minute quantities—and water-soluble bases. The alkaloid and the various other fractions were then 'passed through pharmacological tests, but no remarkable activity was manifested on the gastro-intestinal tract, circulation, respiration, etc., nor was there any marked effect on the uterus whether virgin or pregnant, isolated or *in situ*. In the absence of any signs of physiological activity, clinical trials were not carried out.'

It was left to K. C. Bose to solve the problem satisfactorily. 'The root-bark is an emmenagogue and uterine tonic. The action of the dried root as well as the sap of the fresh root, has been studied in my laboratory. It showed a tonic contractile action on the uterus and its use is, therefore, indicated before the menses, to help the uterine contractions to bring about a proper flow of menstrual blood. The active principle of the drug is totally destroyed if mixed with alcohol or any other preservative; either the fresh root-bark or dried root-bark should be used.'

Assam: Gunakhiakarai—; Bengal: Olatkambol, Ulatkambal, Ulutkambal—; Bombay: Olatkambol—; Canarese: Melpundigida; Ceylon: Ulatkambal—; English: Devil's Cotton—; French: Abrome—; German: Abrome—; Hindi: Kumal, Ulatkambal, Sanukapashi—; Indo-China: Bom vang, Tai meo—; Philippines: Anabo—; Tagalog: Anibog, Anibong—; Tamil: Sivapputtutti—; Uriya: Pisachogonjai—.

#### BUETTNERIA.

The genus consists of 60 species inhabiting the tropics; mostly American, a few Asiatic and African.

**Buettneria herbacea** Roxb. occurs in the Western Peninsula, Orissa, the Northern Circars, the Deccan, the Carnatic, and the Konkan.

The rootstock is ground and rubbed on swellings of the legs by the Kols. It is used in combination with Bael fruit, hesel gum, and Banyan root in cholera and diarrhoea. It is given in the female complaint known in Santali as 'prodhoh' (Campbell).

Kolami: Idel sanga—; Porebunder: Adbaubal, Vagdaubal—; Santali: Deku sindur—.

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## ERIOLAENA.

The genus consists of 8 Indo-Malayan species.

**Eriolaena quinquelocularis** Wight, is found in the Bombay Presidency: Konkan, Western Ghats, Deccan, Southern Maharatta Country; in the Madras Presidency: Deccan, the Sandur Hills of Bellary, the hills of Coimbatore, the Western Ghats from Mysore to Travancore at 2,000-4,000 feet.

A poultice made of the roots is said to heal wounds.

Bombay: Budjari-dha-mun;— Chota Nagpur: Bhawat;— Canarese: Gomaj-jige, Kattale;— Konkan: Bujaridamu;— Malayalam: Vetinar;— Mundari: Bunduddaru;— Tamil: Malamtutti, Nayunnu, Vattanunnu.

## GUAZUMA.

The genus consists of 5 species, natives of tropical America.

*G. ulmifolia* Lam. is used medicinally in Colombia, Brazil, and La Reunion.

**Guazuma tomentosa** H. B. and K., a native tropical America, is found frequently cultivated in India.

The bark is tonic and demulcent, and is used with benefit in some of those cases in which calumba and gentian are indicated (Moodeen Sheriff).

The inner bark is esteemed as a remedy for elephantiasis in the West Indies; the infusion of the old bark is considered sudorific, and useful in cutaneous diseases and diseases of the chest.

In Mauritius the fruit is used as a pectoral in cases of bronchitis.

Bengali: Nipaltunth;— Deccan: Bandog;— Canarese: Bucha, Rudrakshi;— Ceylon: Patti-parutti;— English: Bastard Cedar, Honey Fruit Tree, Musket Tree;— Honduras: Bay Cedar;— Malayalam: Rudraksham;— Mauritius: Caca pôle, Orme pyramidale, Thain pachai;— Sinaloa: Guasima;— Tamil: Rudrasam, Tenbachai, Tengai, Tubakki, Uruttiracham;— Telugu: Rudraksha, Udrikpatta;— Tulu: Rudrakshi;— Uriya: Debodaru.

## HELICTERES.

The genus consists of 40 species, distributed over the tropics of both worlds.

The following species are used medicinally in Indo-China and the Philippine Islands—*H. Isora* Linn.;— in Brazil—*H. brevispira* A. Juss., *H. corylifolia* Nees and Mart., *H. ovata* Lam., *H. Sacarolha* A. Juss., *H. Vuarama* Mart.

**Helicteres Isora** Linn. is rarely found in open country; it occurs in the dry forests throughout Central and Western India, and from the Punjab and Bengal to Ceylon and Burma. It is distributed to Malaya, Australia, and the West Indies.

The juice of the root is said to have a beneficial effect in empyema and stomach affections. In the Konkan it is used in diabetes, and is a favourite cure for snake-bite.

The bark is used in diarrhoea and dysentery.

The fruits are made into a liniment for sores of the ear, and they are administered internally for colic. They are demulcent,

mildly astringent, and useful in the griping of bowels and flatulence of children.

The Santals credit the root, the bark, and the fruit with the same therapeutic properties: demulcent, expectorant, astringent to the bowels, a cure for scabies when applied topically.

The fruit, under the name of Chabei Pintal, is sold as a drug in the shops of Malaya.

A decoction of the leaves is used as an enema in Jamaica.

Mhaskar and Caius have shown experimentally that neither the bark nor the root is an antidote to snake venom.

*Arabic*: Altwā-al-latu—; *Banwara*: Anteri—; *Bengal*: Antamora, Antomura, Atmora—; *Berar*: Marorphal, Muradsheng—; *Betul*: Aitha, Aithi—; *Bombay*: Kāvun, Kevana, Kewan, Khiran—; *Burma*: Khungiche, Thuguaykhyne, Thungeche—; *Canarese*: Bhutakarulu, Edamuri, Kadukalnaru, Kaiyuri, Kavargi, Murudi, Narukolu, Thunshulla, Yadamuri, Yedamuri—; *Central Provinces*: Boltukā—; *Ceylon*: Kawa, Vullum-puri—; *Deccan*: Dhameenee, Dhamni, Kewan, Kewanne, Maradsing, Marorikephalli—; *Godaveri*: Itah—; *Gond*: Aita—; *Gujerati*: Murdasing—; *Haldwani*: Benwa—; *Hindi*: Bhendu, Jonkaphal, Kapasi, Maraphal, Maraphalli, Marorephalli, Marorphal, Marorphali, Marosi, Merosi, Murad, Muradsing—; *Indo-China*: Cay do tron—; *Kharwar*: Aita, Aitem, Aiteni—; *Khond*: Kavali, Korajbothi, Pitabaranda—; *Kolami*: Goinr, Potoporla, Renta, Sakomsang, Sinkari—; *Konkani*: Kiyani—; *Khmaon*: Marorphal—; *Kürku*: Korajbothi, Koributa—; *Lambadi*: Moldaphaliro—; *Malay*: Mori—; *Malayalam*: Ishvaramuri, Kaivalanara, Kaiyuna, Valampiri—; *Marathi*: Kewan, Muradsing—; *Matheran*: Dhamni, Kewan, Muradsing—; *Monghyr*: Ainthiadhanin—; *Mundari*: Rantadara, Rentadaru—; *Nimar*: Aitha, Aithi—; *North-Western Provinces*: Bhendu, Marorphal—; *Persian*: Kishtburkisht, Pechaka—; *Porebunder*: Anted, Antedi—; *Punjab*: Kupasi, Marorphali—; *Saharanpur*: Kapasi—; *Sanskrit*: Avartani, Mrigashinga—; *Santal*: Petcamra, Petchamra—; *Sind*: Vurkatee—; *Sinhalese*: Liniya, Liniyagass, Zimiagaha—; *Tamil*: Vadampiri, Valamburi, Valampuri, Valumberi—; *Teheran*: Pachman-i-pub—; *Telugu*: Adasamanti, Adasyamali, Gubadarrā, Gubalada, Kavanchi, Nulitāda, Nuliti, Peddasamanti, Sadala, Samanti, Syamali, Tada, Uttrasi, Valambiri—; *Tulu*: Kaiycli, Muriga—; *Urdū*: Marorphali—; *Uriya*: Murmuria, Orola, Kaval, Modimodi, Murimuri.

#### KLEINHOVIA.

**K. Hospita** Linn., the sole representative of the genus, inhabits the tropics of both hemispheres. It is found in the Eastern and Western Peninsulas of India, and distributed to Malacca, Singapore, Ceylon, Java, the Philippine Islands, and East Tropical Africa.

A decoction of the leaves is used in the Philippine Islands as a remedy for scabies, and as a lotion for cleaning skin eruptions.

*Ilocano*: Bignon, Bitnog, Bitnong—; *Indo-China*: Tra—; *Pampangan*: Panampat—; *Philippines*: Bitang, Bitnon, Pampar—; *Sunderbuns*: Bhola—; *Tagalog*: Tan-ag—; *Visaan*: Hamitanaga, Tan-ag—.

#### MELOCHIA.

The genus consists of 65 tropical species.

*M. borbonica* Cav. is used medicinally in La Reunion, *M. pyramidata* Linn. in Mauritius.

**Melochia corchorifolia** Linn. is found in the hotter parts of India from Kumaon to Sikkim and the Malacca Peninsula; in Cutch

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Gujarat, the Konkan, and North Kanara; in most of the districts of the Madras Presidency, and in Ceylon.

The whole of this plant, with the exception of the root, boiled in oil, is supposed on the Malabar Coast to be an efficacious remedy for preventing bad consequences from the bite of a water snake (Ainslie).

Water snakes are harmless (Caius).

Bengal: Tikiokra, Tikiopra—; French Sudan: Togoyo—; Fulani: Tukurra—; Hausa: Tukurra—; Hindi: Bilpat—; Malay: Lumah ketam; Malayalam: Seruvuram—; Mende: Ndopa-yengei, Ngengele—; Mundari: Dela ara, Delka ara—; Philippines: Calingan—; Santali: Thuiakarak—; Sinhalese: Hingalkara, Kingalkara—; Sokoto: Tukurra—; Susu: Suri—; Tamil: Chiraparam, Pinnakuppundu, Punnakkukkirai—; Telugu: Ganugapindikura, Sittantakura, Tutturubenda—; Timne: Kirkinkirin-Kobanabana—; Uriya: Chyeron, Dasoke-rotan, Nolita—; Wolof: Pag hou gor—.

## PENTAPETES.

The only representative, *P. phoenicea* Linn., is indigenous in North-Western India, Gujarat, and Bengal. It is distributed to Malaya, Java, the Philippine Islands, and China.

The fruit is mucilaginous. The root is employed as a medicine by the Santals. The plant is used as an emollient in Annam and in China.

The Chinese use the plant in indigestion and in atony of the stomach.

Bengal: Bandhuli, Doopahuria, Katlala—; Chinese: Ou Chè Hoa, Ou Ts'ai Hoa—; Gujarati: Duporio, Sowbhagyasundari—; Hindi: Dopaharia, Daparia, Dopphoria—; Indo-China: Da lac kim tien, Hoa ti ngo, Ngo thi tra—; Marathi: Tambridupari—; Punjab: Guldupaharia—; Sanskrit: Arkavallabha, Bandhujiva, Bandhujivaka, Bandhuka, Bandhula, Bandhura, Haripriya, Jvaraghna, Madhyadina, Madhyanika, Oshthapushpa, Pushparakta, Rakta, Raktaka, Raktapushpa, Saratapushpa, Supushpa, Suryabhaka—; Santal: Barebaha—; Tamil: Nagappu—.

## PTEROCYMBIUM.

The genus consists of 2 species, natives of Burma, the Nicobars, and Malaya.

*Pterocymbium javanicum* R. Br. is found in the open forests of Malaya by creeks or open woodland. It is distributed to Burma, Nicobars, Java, and Philippines.

The tree yields a gum which is a fair substitute for tragacanth.

Burma: Tshaw—; Malay: Kluet, Kulunot—.

## PTEROSPERMUM.

The genus consists of 20 species, natives of tropical Asia.

- |   |                          |
|---|--------------------------|
| A. Bracteoles linear, entire, very caducous. Leaves 5-15 by 2.5-5 cm. ... | <i>P. suberifolium</i> . |
| B. Bracteoles lacinate or palmately divided.                              |                          |
| 1. Leaves 25-35 by 15-30 cm. ...  | <i>P. acerifolium</i>    |
| 2. Leaves 10-15 by 5-9 cm. ...  | <i>P. heyneanum</i>      |

1. **Pterospermum acerifolium** Willd. is found in the sub-Himalayan tract and outer Himalayan valleys and hills up to 4,000 feet, from the Jumna easterwards to Bengal, Chittagong, and Burma. It is extensively planted in the Bombay Presidency.

The down on the leaves is used by the hill-people in Sikkim to stop bleeding in wounds.

In the Konkan the flowers and bark, charred and mixed with kamala, are applied in suppurating small-pox.

The flowers are used as a general tonic. They are employed by Bengalis as a disinfectant and to keep insects away from bed clothes. They are also said to render water gelatinous.

*Bengal*: Kanakchampa, Muchokunda, Mus—; *Bombay*: Kanakchampa, Karnikara—; *Burma*: Tha-ma jam wai-soke, Toungetwun—; *Canarese*: Kanakachampaka, Rajataru—; *Hindi*: Kanakchampa, Kanier, Kathachampa—; *Jaunsar*: Mayeng—; *Kachin*: Magwi napa—; *Kolami*: Muchukundi—; *Konkani*: Kanokchampo—; *Lepcha*: Numbung—; *Magahi*: Gaik—; *Michi*: Laider—; *Mundari*: Makcunddaru—; *Nepal*: Hattipaila—; *Philippines*: Bayoc—; *Sanskrit*: Karnikara, Mushukunda, Padapotpala, Parivyadha—; *Santali*: Machkunda—; *Tamil*: Vennangu—; *Telugu*: Matsakanda—; *Tharu*: Machkan—; *Uriya*: Konokochompa, Mushukundo.

2. **Pterospermum heyneanum** Wall. occurs in the Western Peninsula.

The leaves are used in leucorrhoea; they are smoked like tobacco.

*Khond*: Baili—; *Tamil*: Polavu—; *Telugu*: Duddika, Loluga, Machchakanda, Nolika—; *Uriya*: Bailo, Giringa, Machkunda—.

3. **Pterospermum suberifolium** Lam. is found in the Northern Circars, and Carnatic. It is sometimes planted in the Bombay Presidency.

The flower rubbed into paste with rice vinegar is an ancient and well known application for hemicrania. It is said to render water gelatinous.

*Bengal*: Muchkand, Muchukunda, Muskunda—; *Bombay*: Muchunda, Muchukunda—; *Burma*: Naji—; *Canarese*: Muchukunda—; *Ceylon*: Tada, Toddi, Vinanku, Vinnaku—; *Hindi*: Muchkand—; *Konkani*: Munchund—; *Marathi*: Muchkund—; *Sanskrit*: Arghyarhalakshanaka, Bahupatra, Chitraka, Dirghapushpa, Harivallabha, Kshatravrikha, Muchukunda, Mündivrikshanukaraka, Prativishnuka, Raktaprasava, Sudala, Supushpa—; *Sinhalese*: Velanga, Velenge, Venangu—; *Tamil*: Sembolavu, Sittilaipolavu, Tada, Vennangu—; *Telugu*: Lolagu, Narudu, Tada—; *Uriya*: Baelo, Giringa, Guputi, Gureno—.

#### PTERYGOTA.

The genus consists of 4 palaetropical species.

**Pterygota alata** R.Br. (= *Sterculia alata* Roxb.) occurs in the Western Peninsula, Sylhet, Chittagong, Pegu, and Martaban down to Tenasserim. It is also found on the Andamans.

In Sylhet the seeds are used as a substitute for opium.

*Assam*: Tula—; *Burma*: Letkope—; *Canarese*: Bekaro, Jaynkatala—; *Chittagong*: Buddhanarikella—; *Malayalam*: Anattonti, Porila, Porutonti—; *Tamil*: Anaittondi, Kodaittondi—.

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## SCAPHIUM.

The genus consists of 4 species found in Martaban, the Malay Peninsula, and Borneo.

Leaves 15-20 by 10-12.5 cm.	...	...	1. <i>S. affine</i> .
Leaves 30-35 by 15 cm.	...	...	2. <i>S. Wallichii</i> .

1. **Scaphium affine** Ridley is fairly common in the forests in the south of the Malay Peninsula.

The fruit acts as a demulcent.

The seed, immersed in water for a night, exudes a gum, containing bassorin, to such an extent as to fill a small cup. This, mixed with sugar-candy, is eaten as a stomachic, and is very pleasant and wholesome.

Malay: Kembang semangkok, S'ilayer—.

2. **Scaphium Wallichii** Schott and Endl. (= *Sterculia scaphigera* Wall.) is common in the tropical forests along the eastern and central slopes of the Pegu Yomah and Martaban. It is also found in Chittagong, Tenasserim, and Malacca.

The fruit is used in China as a remedy for piles and dysentery, and for diseases of the lungs and the kidneys.

In Cambodia, Siam, and Malaya the fruit is macerated in water, when the outer shell or pericarp increases enormously in volume forming a large gelatinous mass. The jelly is sweetened and eaten as a delicacy, and is said to be a specific in diarrhoea and dysentery.

Chinese: Ta Hai—; Malaya: Kembang semangkok, Tai hoi—; Siam: Bungtalai—.

## STERCULIA.

The genus consists of 100 tropical species.

Many of the species yield gums in considerable quantity, most of which resemble tragacanth in their appearance and properties.

The following are used medicinally in Japan—*S. javanica* R.Br.—; in the Philippine Islands—*S. Balanghas* Linn., *S. foetida* Linn., *S. oblongata* R.Br., *S. rubiginosa* Vent., *S. stipularis* R.Br., *S. urens* Roxb.—; in Indo-China—*S. hypochroa* Pierre, *S. lychnophora* Hance, *S. platanifolia* Linn., *S. foetida* Linn., *S. Thorelii* Pierre—; in China—*S. platanifolia* Linn.—; in West Africa—*S. tomentosa* Guil. and Perr., *S. Tragacantha* Lindl.—; in Australia—*S. acerifolia* A. Cun., *S. diversifolia* G. Don., *S. rupestris* Benth.—; in Brazil—*S. chicha* St. Hil., *S. striata* A.St.Hil. and Naud.—.

A. Leaves digitate ... .. *S. foetida*.

B. Leaves palmately lobed ... .. *S. urens*.

C. Leaves simple; not lobed, 1-nerved.

Calyx-lobes narrow, incurved, frequently cohering at the tips, gaping at the sides.

1. Leaves pubescent beneath ... .. *S. Balanghas*.

2. Leaves with the nerves rusty-hispid beneath. *S. rubiginosa*.

1. **Sterculia Balanghat** Linn. is found throughout the hotter parts of India, on the coasts of Tenasserim, in Ceylon, and the Andaman Islands.

In the Philippines the fruit is considered cooling and laxative.

*French*: Bois de cavalan—; *Malayalam*: Kavalam—; *Philippines*: Balan ghas—; *Sinhalese*: Nawa—.

2. **Sterculia foetida** Linn. occurs in the forests of Western and South India at low elevations. It is also found in Burma, Ceylon, and the Malay Peninsula. It is distributed to East Tropical Africa, the Philippine Islands, and North Australia.

The oil from the seeds is a mild laxative and is used as a carminative. The seeds when swallowed incautiously bring on nausea and vertigo.

The leaves are repellent and aperient.

A decoction of the fruit is mucilaginous and astringent.

In Java the fruit is employed in gonorrhoea.

*Bombay*: Junglibadam, Pun—; *Burma*: Hlyampyu, Letkok, Shawbyu, Showbju—; *Canarese*: Bhatala, Bhutaili, Gotinakayi, Jaynkatala, Jenukayitaili, Kuduregotu, Penari—; *Ceylon*: Kaditeni, Pinari—; *French*: Arbre puant, Bois caca, Bis Bois de cavalan, Bois de merde, Bois puant—; *Goa*: Junglibaddam, Kuomhad, Virhoi—; *Hindi*: Jangalbadam, Janglibadam—; *Ilocano*: Bangar—; *Indo-China*: Chim chim rung, Trom—; *Jolo*: Caumpang—; *Konkani*: Cun-venruc, Viroi—; *Malay*: Kelompang—; *Malayalam*: Pinari, Pottakavalam—; *Marathi*: Goldaru, Janglibaddam, Nagalkuda—; *Muduva*: Kaludaivitte—; *Pampangan*: Calumpang—; *Portuguese*: Puna, Puna bastarda—; *Pulaiya*: Kesalamaram—; *Sinhalese*: Telambu—; *Tagalog*: Calompan, Calumpag, Calumpang—; *Tamil*: Arali, Attirappidukkan, Kudiraippidukku, Malaittengai, Pinari, Pudagarappanbattai—; *Telugu*: Guttapubadamu, Manjiponaku, Piyyattiponaku—; *Tulu*: Pinari—; *Visayan*: Bobag—.

3. **Sterculia rubiginosa** Vent. is common in woods in open country in Burma and the whole of the Malay Peninsula from Singapore to Penang. It is distributed to Cochin-China, Java, and Sumatra.

The fruit is used as a mild laxative.

*Malay*: Dundanak, Saburu, Sakelat, Unting-unting besar—; *Tagalog*: Nato—.

4. **Sterculia urens** Roxb. occurs in North-Western India, Assam, Behar, the Eastern and Western Peninsulas, and Ceylon.

The leaves and tender branches steeped in water yield a mucilaginous extract, useful in pleuro-pneumonia in cattle.

The gum, known as *karai-gond*, is used as a substitute for tragacanth in Bombay.

The Santals consider the gum a useful medicine in throat affections.

In Philippines the root bark is pounded, made into a poultice, and applied to wounds, and fractures; it is also used in orchitis.

*Ajmere*: Kalru, Katila—; *Assam*: Hatchanda, Odlā—; *Banda*: Kulu—; *Barar*: Guru, Kairu, Karai, Kulu, Taklej—; *Belul*: Guru, Karai, Kulu—; *Bombay*: Gular, Gulu, Gwira, Kadai, Kandai, Kando, Kandol, Kandula, Kawalee, Kullin, Kulu, Pandruka, Sardol, Sardora—; *Canarese*: Bhutali, Kempudaili, Kempudala, Kempudale, Pinari, Punike—; *Central Provinces*: Gulu, Gurlu, Karhar, Kulu—; *Ceylon*: Kavali—; *Deccan*: Kurdu—; *French*: Sterculia démançant, Touroutier—; *Gond*: Hittum, Pinoh—; *Gujerati*: Kada, Kagdol, Karai—; *Hindi*: Bali, Gular, Gulu, Kabru, Karrai, Katira, Kuli, Kulu, Tabsi, Tanuku—; *Jeypore*: Kaddu, Karr—; *Khandesh*: Kud—; *Khawar*:

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Kaunji—; *Khond*: Gauduli, Gendule—; *Kolani*: Feley, Kaunji, Teley—; *Konkani*: Pandruk—; *Kurku*: Takli—; *Malayalam*: Tonti—; *Manbhum*: Keonge—; *Marathi*: Gwira, Kandol, Kandula, Karai, Kavali, Pandruka, Soldawar—; *Matheran*: Bandruk, Kaoli, Kuari, Sardol—; *Melghat*: Teklej—; *Mewara*: Kor—; *Monghyr*: Kanaunji, Karaunji, Mogul—; *Mundari*: Burkunda, Gurkaranj, Makchund—; *Nimar*: Gūru, Karai, Kulu—; *North-Western Provinces*: Gulli, Kuli—; *Panch Mahals*: Kalauri—; *Porebunder*: Kadai, Kadayo—; *Santali*: Telhec—; *Tagalog*: Banilad—; *Tamil*: Kavalam, Puttali, Sendalai, Sendauakku, Sigapputtanakku, Tanakku, Vellaiputtali—; *Telugu*: Ettaponaku, Kavali, Kavili, Ponaku, Tanuku, Tapasi—; *Uran*: Keunji—; *Uriya*: Girungilia, Gudalo, Kavili—; *Visayan*: Banilad—.

## TARRIETIA.

The genus consists of 7 species inhabiting Malaya, Cochin-China, and Australia.

**Tarrietia unifoliolata** Ridl. occurs in Malacca. The plant is used medicinally by the Malays.

*Malay*: Kamuning hutan—.

## THEOBROMA.

The genus consists of 20 species, natives of tropical America.

The seeds are analeptic. They yield a fixed oil known as 'oil of Theobroma' or 'Cacao Butter', and they are extensively used for the extraction of the alkaloid 'theobromine'.

The species used are all originally South American: *T. bicolor* H. and B., *T. cacao* Linn., *T. glauca* Krst., *T. martiana* D. Dietr., *T. macrantha* Bernoulli. *T. microcarpum* Mart., *T. syvestris* Aubl.—

**Theobroma Cacao** Linn. has long been introduced into India, and is cultivated in the Southern Presidency and Ceylon.

A light yellowish, opaque, solid oil, known as 'Cacao butter', is prepared for use in pharmacy, by pressing the warmed seeds. It is officinal in the pharmacopœias of Austria, Belgium, Brazil, Denmark, Finland, France, Germany, Great Britain, Holland, Hungary, Italy, Japan, Mexico, Norway, Portugal, Russia, Spain, Sweden, Switzerland, Turkey, United States, Yugoslavia.

The seeds contain from 1.5 to 2.4 per cent theobromine.

*Ceylon*: Chocolatgas, Cocomaram—; *Dutch*: Cacaoboom, Kakauboom—; *English*: Cacao, Chocolate Tree, Cocoa—; *French*: Cabasse, Cabosse, Cacao, Cacaotier, Cazaoyer—; *German*: Kakaobaum—; *Guam*: Kakao—; *Hungarian*: Kakao, Kokuszfa—; *Italian*: Albero del Cacao, Cacao—; *Mexican*: Cacacoatl—; *Portuguese*: Cacao—; *Roumanian*: Cacaotier—; *Russian*: Kakao-voi derevo—; *Spanish*: Arbol del cacao, Cacaõ, Haba de Mejico—; *Swedish*: Kakao—; *Turkish*: Kakao—.

## WALTHERIA.

The genus consists of 30 species, mostly American.

*W. Douradinha* A. St. Hil. is used medicinally in Brazil.

**Waltheria indica** Linn. is a widely diffused tropical weed, common in all the hotter parts of India, from Kumaon at 4,000 feet to Malacca and Ceylon.

In Mauritius the plant is credited with emollient and bechic properties, and is used as a cough medicine.

In West Tropical Africa the plant is a common medicine for infants. In Northern Nigeria the infant is given to drink or to sniff or inhale a decoction of the root boiled along with native natron. In Yoruba and in Togo the plant is a constituent of various infusions, both to drink or as wash for a few weeks to strengthen the child's resistance against fevers and other troubles.

Amongst the Hausas the root is considered to be purgative; also a decoction of the plant is believed to be a preventive of syphilis, and, if taken frequently, to afford immunity. It is also drunk by agriculturists as a restorative during the labours of harvesting.

In Togo a spoonful of the pulverised plant with hot water is taken morning and evening as a cough medicine.

In Gold Coast the plant is used to cause abortion.

The Thàngaan women take a decoction of the root for barrenness.

The Sutos either chew the raw root or drink a decoction of it for internal haemorrhages.

*Bambara* : Dabada—; *Fulani* : Kafafi, Kapappi—; *Ga* : Fufunoba, Nansuru—; *Gbari* : Nyiknapmiyaya—; *Hausa* : Hankufa, Yankufa—; *Malinke* : Bourai—; *Mauritius* : Guimaube, Guimaube créole, Toutti—; *Mende* : Ngala-yuyui—; *Shàngaan* : Simbongana—; *Suto* : Lexutasela—; *Telugu* : Nallabenda—; *Togo* : Adu weti, Bati—; *Twi* : Apem—; *Uriya* : Bojoromuligna—; *Wolof* : Bourai—; *Yoruba* : Korikodi, Opa-emere—.

## MORE ABOUT THE FLAMINGO [*PHOENICOPTERUS RUBER ROSEUS* (PALLAS)] IN KUTCH.

BY

SALIM ALI.

(With 2 plates.)

When Mr. C. McCann visited the 'Flamingo City' in the Great Rann in October 1935 the nesting season was unfortunately almost over. There were evidently no fresh eggs, or eggs being brooded, at the time and most of the adult birds seemed to have left. What he was chiefly able to see was a large number of non-flying young birds in various downy and juvenile stages. His interesting account, published in Vol. xli of the Journal (August 1939, pp. 12-38) is a useful contribution to our knowledge of this species.

When I first visited the nest 'city' eight years later (in October 1943) I had even worse luck. It had been reported earlier in the season that large concentrations of flamingoes—'7 to 8 thousand'—had been observed in that area. As the monsoon had been favourable, and water conditions in the Rann after a series of drought years at last seemed as required, it was confidently expected that the birds would breed. Some unfavourable factors

appear to have intervened, however, for when I visited the nest 'city' later on, during the first week of October, the water had receded a long way leaving the nests high and dry. From the desiccated condition of the ground surrounding the nests it was evident that the water had been gone a month or more. The clear imprints of flamingoes' feet around and in among the nests, the fresh 'scoops' in the mud when it must have been wet, and the partial replastering of old nest mounds showed that the birds had certainly been there when the place was inundated and had commenced to rehabilitate the deserted 'city'.

The following monsoon (1944) was a particularly heavy one. The nesting grounds were apparently immersed in such deep water until December or January that no nesting by the birds would have been possible, and it looked as though the birds would have to skip yet another season. It seemed rather extraordinary, however, that they should miss season after season and apparently fail to reproduce altogether for so many consecutive years. And it seemed worthwhile to determine whether, given favourable conditions, the flamingo may not breed at a different season to what was so far known. Here was the opportunity. At my suggestion, and with his characteristic keenness, His Highness Maharao Vijayarajji very kindly arranged to have the relevant area of the Great Rann suitably patrolled for as long as any water stood there, even well after the known breeding time was past. Such a step appeared at first to be waste of time and labour, but we had not long to wait before it was proved justified. Contrary to precedents, flamingoes were reported by the patrols to be concentrated and nesting in great abundance at their accustomed spot in late March 1945, when the water level in the Rann had subsided to what it is in normal years towards the end of the monsoon season. His Highness at once despatched a reliable shikari to obtain confirmation of this unusual happening, and also sent the State photographer along to get a graphic record of the same. These men returned on 10th April with unquestionable evidence—some excellent photographs showing enormous numbers of birds at their nests, and eggs collected in the colony both fresh and in various stages of incubation. One of these eggs actually hatched out in the cardboard box in which it was kept. Upon H. H. telegraphing to me in Bombay I lost no time in arriving on the scene. Sir Peter Clutterbuck who chanced to be in Bhuj at the time, in spite of the fact that he is no longer as young as he used to be, was enthusiastic enough to face the heat and hardships of the journey and accompany me. We camped as before at Nir on the N-E tip of Pachham Island. The flamingo 'city'—the same used in successive seasons—is located directly N-E of Nir, 6 to 7 miles out in the Great Rann. It is on a dry pancake-flat 'island' which at the time of our visit was about one mile long (W to E) and about half a mile in width. To reach it one had to wade or ride through shallow water—more or less concentrated brine—ankle to thigh deep for most of the distance, interspersed here and there by other similar 'islets' whence the wind

had temporarily driven off the water. The average time taken to reach the 'city' from Nir was 2 hours and 40 minutes.

The first visit to the colony was made on the morning of 19 April accompanied by Sir Peter Clutterbuck. On the 20th afternoon I visited the place again—alone this time—arriving there at 6-45 p.m. and bivouacing overnight. I left the colony at 11 a.m. on the 21st. A third visit was made on the afternoon of 22nd April which lasted till 11-30 a.m. on the following day. These notes, scrappy as they necessarily have to be from the shortness of the time at my disposal, are the result of the three visits—particularly of the last two when unhurried observations were possible, and also some during the night under a bright, nearly full moon.

*Meteorological Conditions.*—Temperature: Minimum (during night)  $77^{\circ}\text{F}$ ; Maximum (at 11 a.m.)  $116^{\circ}\text{F}$ . Presumably considerably hotter in the afternoon. In the above instance, the thermometer stood against a nest-mound on its shady side and was not exposed directly to the sun as the eggs and young are. A newly hatched chick died when left exposed on a nest-mound for between half and one hour (about 10 a.m.).

Practically all day and all night a strong wind was blowing from NW (or NNW) to SE with often the intensity of a Moderate Gale (Force of the Beaufort scale = 28 to 33 m.p.h.) Sky clear. Visibility good in early morning, getting hazy in distance (near horizon) after sunrise. Nights clear, moonlit.

*The Nest 'City': Its extent and population.*—The 'city', to the nests on its extreme periphery, measured 480 yards (W to E)  $\times$  245 yards = 117,600 square yards. Sample plots were selected at random, each 10 yards  $\times$  10 yards = 100 square yards, and nests on these counted, as follows: 135, 151, 128, 110. Average 131. The result of a further independent count on the second day was essentially the same. Taking off 20% of the total area for the bald (unbuilt) patches interspersed in the middle and on the outskirts (117,600 less 23,520) leaves 94,080 square yards. Therefore total number of nests in the city 123,245.

Taking off 15% of the above for old nests and those not in use at present (123,245 less 18,487) leaves 104,758 active nests. Counting 2 adult birds to each nest ... 209,516

„ say only 2 young to every 3 nests ... 69,839

Total population of the city : 279,355 birds

It seems to me more than likely that at least 2 successive broods are raised. Enormous numbers of young birds of the year were scattered in the shallow water all along the periphery of the island so that the population of flamingoes within sight in this area at present, including breeding and non-breeding adults and young in all stages, could on a conservative estimate, not have been less than about 500,000 (half a million) birds.

*Food.*—The question of the food of the flamingo in the Rann is naturally of great interest considering the vast population it has to support for certainly not less than 3 months in the year, and possibly

much longer. Both Ticehurst in Sind and McCann in the Great Rann found seeds, mostly of aquatic freshwater or waterside plants in flamingoes' gullets and stomachs. There is so far no justification, however, for supposing that these constitute the only or indeed the staple diet of flamingo in these parts. It seems difficult to conceive that sufficient quantities of such seeds, e.g. *Ruppia*, could be washed down by the rivers flowing into the Rann from the north-east to sustain a population of this magnitude for so long a period. The matter calls for careful investigation. The stomachs of 2 adult birds shot by me in the salt pans at Kandla in September (1943) contained ca  $\frac{3}{4}$  oz. (when dry) of grit or coarse sand (ca 1 mm. in diam.). In addition to this there was a small quantity of slimy greenish-brown vegetable matter like the 'scum' from the bottom of the salt pans, and a large number (over 50 in each case) of red thread-like 'worms' ca 10 mm. long, later identified as *Chironomus* larvae. The latter figured largely also in the stomach contents of Dunlins and other waders frequenting the salt pans at this period.

*Adults.*—When a bird first settles on eggs it pivots from side to side until comfortable. Birds sitting on nests, and at ease, have their back feathers (scapulars) frowzled and erected, looking like gigantic chrysanthemums! An incessant babbling 'roar'—*kakak, kaka, kākāk* etc. (of the wheezy quality of a mallard drake's quack, but louder) and goose-like gentle honks in varying keys, emanate from the nesting colony day and night. Birds not brooding stand upright beside their partners and usually have their backs to the sun. Thus from a distance the assemblage is clearly seen in two tiers, as it were, and from the side all birds appear in profile, facing away from the sun. A considerable, and almost continuous, traffic was kept up during the bright moonlit nights between the nest city and various parts of the Rann, evidently the birds foraging. Birds sitting on nests when approached, were far less loth to leave the contents exposed during the night than in the heat of the day.

When the 'city' was visited by the shikari and photographer in the first week of April, most nests contained eggs—only one each—as will be seen from the photo reproduced. In the 3rd week of April (between 20th and 23rd) single newly hatched chicks or chipping eggs predominated. Besides these there were large numbers of slightly older downy chicks running about all over the place in among the nest-mounds. A considerable number of nests, moreover, still had fresh eggs—invariably one per nest—and there were innumerable others, fresh, hard-set and added lying helter skelter all about the colony at the base of the nest-mounds. It is difficult to say how they got there, since without deliberate effort or some degree of violence it is inconceivable they could roll off over the rim of the 'crater'. Are dislodged eggs ever retrieved? Or is a fresh egg always laid to replace the dislodged one?

*Chicks.*—Flamingo chicks are extremely precocious from even when little more than animated powder-puffs, a few hours old. When lying inert on top of the nest-mounds, necks stretched prone, they will attempt while the observer is still some distance away to slither down the mound and escape, shuffling along balancing themselves with their stumpy wings and waddling comically like some plump small gentleman in a hurry! It is a puzzle how the adult birds ever find their own nests and eggs and/or chicks from amongst the close-packed thousands that extended for acres. But I think that once the young have begun to run about, and confusion becomes worse confounded, and until such time as they are led out into the shallow water to fend for themselves (apparently only a matter of days) the community is run on a communistic basis, and adults feed young more or less indiscriminately. No other course seems imaginable. When the nest colony was approached, the adults gradually moved off towards the water's edge followed by a dense broad band of downy chicks, like a conveyor belt, running alongside them, in amongst and around their legs or trailing behind like scared refugees from a bombarded city. When approached closer, most of the adult birds flew off leaving only a handful of the bolder ones in charge. These were loth to desert the chicks, and only did so in the last resort, when hard pressed. Thus it was not unusual to find about 20 adult birds leading off a thickly packed jostling army of several hundred downy chicks of all ages and sizes, from those scarcely 3 or 4 days old upwards. A plausible explanation for the strongly webbed feet of the flamingo now occurs to me. Old birds use them for swimming but comparatively rarely. Their legs are long enough to enable them to wade into all the depth of water they normally require for feeding in. The baby flamingo's legs are short and he would never be able to escape enemies or forage for himself in shallow water unless he could swim. This he does remarkably well, kicking out his little legs rapidly to paddle like a duck whenever the water becomes deeper than he can conveniently run in. And he moves much faster and far less unsteadily this way than he can do on land. In the shallows he progresses just like an amphibian jeep, running along or swimming, all in his stride as the depth of the water demands. The tibia and tarsus begin to get disproportionately long at an early age; somewhat older chicks can run extremely fast and are difficult to overtake.

*Enemies.*—Except for a couple of Scavenger Vultures (cf. McCann also) which were observed smashing hardset eggs and leisurely devouring the contents in the interval when the birds had been scared away by our activities, I saw no enemies. A number of such eggs, smashed and with part or the entire contents devoured, presumably by the same agency, were found lying on the nest-mounds or about their base. It appears that these vultures must take a regular but not very considerable toll. From its far-lying and islanded situation the 'city' seemed to be immune from four-footed enemies. Although jackals are plentiful

in the hills about Nir, I saw no evidence during the time I was there of their visiting this place or of any damage that might reasonably be attributed to them. There seems no doubt that the greatest casualty among the eggs and young is due to the scorching relentless sun. The number of dead and desiccated chicks strewn about the colony I can only ascribe to this cause. An instance is given earlier on of the fatal effect of even a comparatively short exposure on a newly hatched chick. The fact that chicks, a few days old, are led away by the adult birds to the shallow water doubtless acts as a safety measure against the broiling heat of the exposed sun-baked nests. It would appear that the chicks thereafter fend for themselves and do not return any more to the nest colony to roost or be fed.

*Migration and Local Movements*—The appeal published in the Journal (Vol. 44. p. 476) with a view to eliciting information on these points has so far met with poor response. We are no nearer to solving the problem of what happens to the flamingo hordes in drought years, when conditions are unsuited for their breeding on their accustomed grounds in the Great Rann. They are apparently able to breed here only once in 3 or 4 years, occasionally even longer periods.

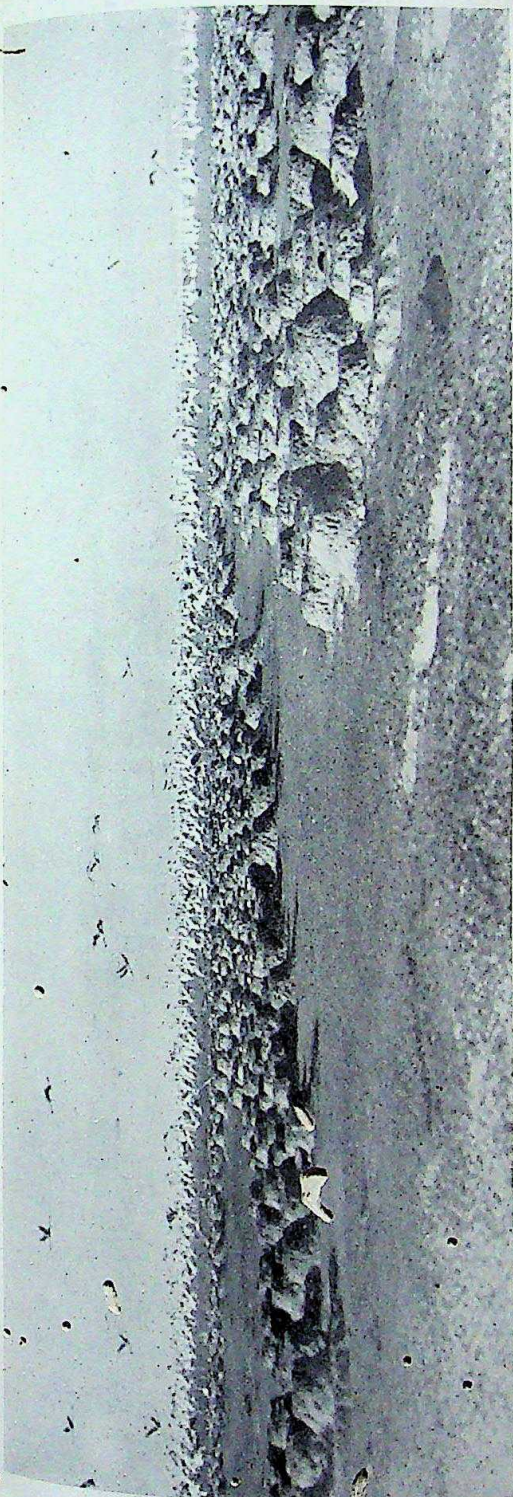
It will be remembered that Mr. McCann by a process of jigsaw-puzzle working in of breeding seasons and dates of recorded movements in Mesopotamia, Persia and elsewhere, put forward a suggestion to the effect that Indian flamingoes perhaps normally migrated to breed in the marshes of Southern Spain, another well known breeding ground. Under favourable conditions, mainly depending on good winter rains, the nesting season there commences in May. His suggestion was that if unfavourable natural conditions were encountered in Spain the birds turned about and made for Kutch. The normal breeding season in the Great Rann being September to October, they would get ample time to do the return journey in. Then if they meet with the required conditions here, they undertake breeding. Thus the marismas of Spain and the Great Rann of Kutch would, according to him, be the erratically used alternative breeding grounds of our Indian flamingoes. Personally I did not at the time, nor do I now, find Mr. McCann's 'supposition' a convincing one, but of course it does not do to be too dogmatic in such matters, and more data are needed. Mr. McCann pertinently observes that to obtain any proof the wholesale ringing of birds in the two areas (Spain and Kutch) would be necessary. It is a pity he had no rings with him when he visited the nest city, when the opportunity for marking seems to have been good. On my recent visit (April 1945) I was fortunate in being able to mark a few young birds. Theoretically there would seem no reason why, provided one got there at the appropriate time as I did, one should not be able to ring a thousand or 5000 or even 10,000 chicks within a comparatively short time considering the immense numbers of them about. In practice, however, the matter proved to be much less simple. With the help of five active locals, ringing 192 birds

all I could do during the best part of 2 mornings. I had no more time at my disposal. For one thing young flamingoes of an age and size suitable for ringing (from about 10 days to 3 weeks old) run like stags and often require all-out sprinting to overtake. For another, the ground on which this race is run is all in the bird's favour. The surface is generously buttered with semi-liquid mud. You slither and slide and skid the whole time. Frequently when just within grasp you lunge at the quarry and suddenly find yourself on your bottom or grovelling in the mire with a perfect worm's eye view of the escaping chick. The only consolation in such a predicament is when you look round and find that half your helpers are in like case. It is exhausting work.

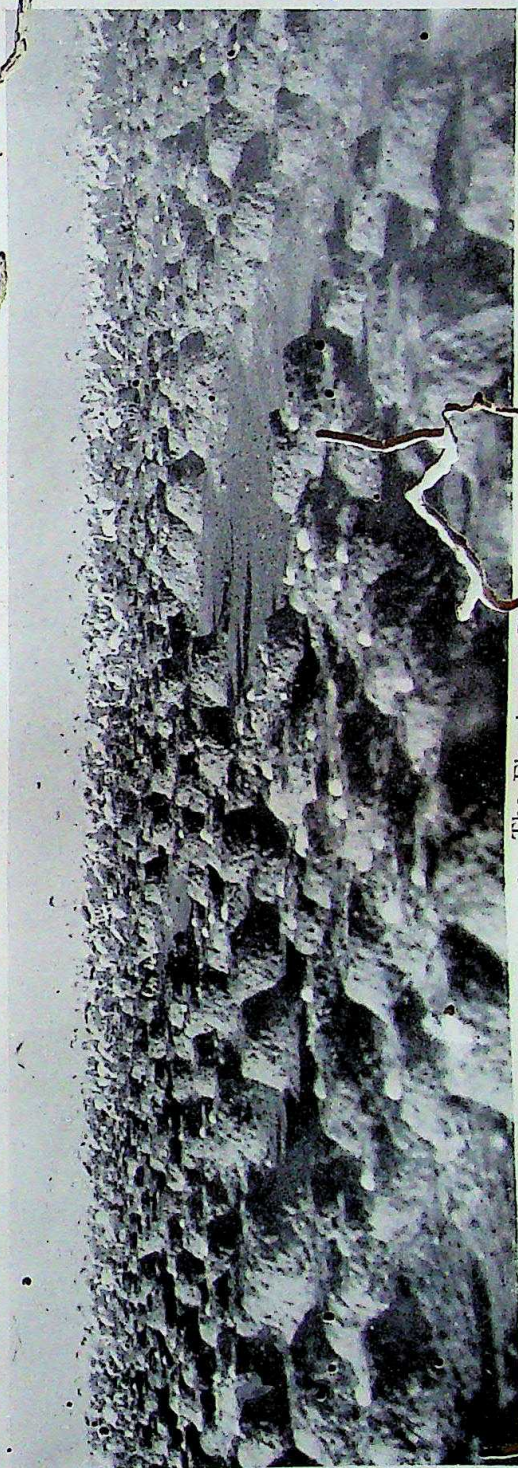
The rings used on the birds are the Bombay Natural History Society's standard duck rings No. 6036 to 6169, and 6301 to 6350. They are all attached on the bare portion of the left tibia (just above the 'knee' joint) so that they may easily be seen at a distance with field glasses. I shall be glad if any of these ringed birds seen are reported to the Society with dates and particulars.

*The Photographs.*—Some of the beautiful photographs that illustrate this note were taken by Ali Mohammad, the State photographer, under conditions that do him great credit and call for special mention.

At a crucial moment, on first arrival at the nest city with Sir Peter Clutterbuck, I discovered that my own camera, fitted with telephoto lens, on which I had been banking so complacently, was out of order. In response to a desperate S.O.S. to Bhui, His Highness kindly sent out post-haste not only his own Kodak for my use, but also the State photographer with complete paraphernalia. Ali Mohammad was accompanied by a special assistant whose exact purpose or function was not apparent at the time. The 2 photographers and their equipment made up 2 complete camel loads. The apparatus—a full-plate studio camera of solid teakwood of enormous size and cumbrousness—looked very like some antique piece of furniture of the period of William the Conqueror or thereabouts. It had no shutter but worked by the dosing and donning of a cap over the lens. And after every exposure you expected the photographer to bow and say 'Thank you'. The results of his sleights-of-hand were, that even with comparatively slow plates and the diaphragm shut down to a pin-point, the plates were somewhat overexposed. (The Weston F 22 with Super XX film). It was obviously a camera with a history and it would not surprise me to learn that it is the same as made the original picture of the flamingo nests in the Rann, published in the *Journal* in 1896 by His late Highness Maharao Khengarji. The apparatus not only needed two men to rig it up for action, but I discovered that the focusing was also a highly complicated cooperative business. It was worked like a ship, and this is where the trained assistant came



1. The Flamingo "City."



2. The Flamingo "City."

Photos by

SALIM ALLI





THE STATE PHOTOGRAPHER.

A close-up of a section of the Flamingo "City."

Photo by



in. The chief photographer (the Captain) had to enshroud his head in several yards of black mourning cloth with his eyes glued on the focussing screen. From this position—the 'bridge'—he had to signal down orders to the 'engine room' as it were, to his assistant in front to turn the focussing knob this way or that, a little more to the right or just a wee bit to the left. The focussing knob was so far in front as to be quite out of reach of the Captain himself, and only a specially trained assistant could assist.

The camera, erected at the nest colony, showed up in the distance like a fair sized house on the bare flat expanse of the Rann. And when a wind sprang up and the black cloth round the Captain's head commenced to flutter and flap I thought there could be no earthly chance of getting any photographs of the birds. At first I was very loth to allow Ali Mohammad to go into action at all for I feared the disturbance might cost me the opportunity of making observations. I am afraid I was also inclined to be rather facetious at the Captain's expense but he bore it all with surprising good nature. It was not until we got back to Bhuj and he produced these (by me completely unexpected) results out of his dark room that I realised the laugh had really been on me. And further, when on return to Bombay I discovered the rather mediocre result of my own efforts with H. H.'s Kodak, it became more obvious than ever that it needs something more than a good camera to produce a good photograph.

## OBITUARY NOTICE.

### SIR NORMAN CRANSTOUN MACLEOD.

Sir Norman Macleod who was Chief Justice of the Bombay High Court from 1919 to 1926 died suddenly on the 5th July, 1945. Sir Norman was always interested in Natural History and was Honorary Treasurer of our Society from 1901 to 1906 and was Vice-President from 1918 to 1924. He was a keen sportsman and a good shot and went out regularly after snipe, quail and duck in the vicinity of Bombay.

Mr. M. R. Jardine—a very old friend of Sir Norman's at the High Court, Bombay, writes saying that Sir Norman continued to take great interest in the High Court both as regards its judgments and its administration right up to the end, and he frequently contributed articles to the Bombay Law Reports under a nom-de-plume.

It is only right that some notice should be recorded in our Journal of one who in his time did so much to help the Society.

W. S. M.

## REVIEW.

A GUIDE TO BIRD WATCHING by Joseph J. Hickey. With illustrations by Francis Lee Jaques and Bird Tracks by Charles A. Urner. Pp. xiv+262. Published by Oxford University Press (1943) Price \$ 3.50.

There are many things the youthful bird lover and the amateur ornithologist are constantly wanting to know about their hobby: How to observe, What to observe, What to record, How to record, What is already known, What has still to be learnt, and so on. Experienced workers are not always on tap, and not all average students can answer their difficulties. Thus it not infrequently happens that an enthusiastic and promising beginner, for want of suitable guidance, has his keenness blunted or diverted into other channels. Here, at long last, is just the book for just such persons, and no doubt the seasoned ornithologist will find it equally illuminating. Some of the chapter headings will indicate the wide scope of its contents: How to begin Bird Study, The Lure of Migration Watching, The Romance of Bird Banding, The Art of Bird Watching. They cover such topics as Distribution, Habitat Selection, Territory, Song, Food, Trapping, Censuses, Co-operative Bird Watching and others that are for ever falling within the purview of the intelligent watcher.

Methods of conducting investigations and the manner of recording and publishing them most usefully, are suggested. This *à propos* of that well-known type—a beginner usually—who is (quite pardonably) carried away by the imaginary importance and uniqueness of the observations he makes, and is convinced that they are all worthy of appearing in print forthwith. He is not a little disappointed, and even peeved, when harassed editors are obliged to differ. With the present and ever-rising spate in ornithological literature it is desirable that people who work or write on any particular aspect of birds should first acquaint themselves in a general way with what work has already been done on similar lines so as to avoid unnecessary redundancy.

The Art of Bird Watching (Chapter 6) with its different sub-headings is particularly lucid and instructive, and will be read with profit by every shade and grade of bird lover. Chapter 3 entitled Adventures in Bird Counting is of special interest to us in India. It is a subject in which we have done no serious work so far, but which obviously holds enormous potentialities. When a proper scientific investigation of the economics of Indian birds comes to be undertaken, as it is bound to be under any well planned scheme of agricultural research, the importance of bird counts will be more fully appreciated. Take for example a species which has been determined by a study of its food and feeding habits to be harmful to agriculture, forestry or fishing interests in a given locality. How is the aggregate damage it causes to be assessed unless and until we possess sufficiently reliable data of the density of its population? It is a completely erroneous and misleading notion that any estimate of numbers is better than no estimate at all. Population counts to be of real use need to be fairly accurate. And in order to obtain accurate estimates certain techniques, evolved after much experimenting in other countries—notably England, America and Germany—have to be followed. The methods vary with local ecological conditions and the species of bird to be dealt with. Some of the methods now in use are described, which could well be modified and adapted to conditions obtaining here. But others will have to be evolved by ourselves to suit our peculiar needs. I have searched the pages in vain for anything to suggest a method of counting that could successfully be applied to some of the conditions we are up against here. For instance how can one obtain even the semblance of an accurate census of the thousands upon thousands of water birds of mixed species—Painted and Open-billed Storks, Herons, Cormorants (of 3 species), Darters, Egrets (of 2 or 3 species), Paddy Birds, White Ibises and Spoonbills—that nest in such bewildering confusion on some of our Indian jheels? In particular I have in mind the Keoladeo Ghana of Bharatpur, which has defeated me more than once. I daresay some comparatively satisfactory method can, and will eventually, be devised. Our problem is to devise it. It is a challenge which some of the census experts in England might well take up, since obviously a greater degree of special experience in this

line of work is called for than is available in our country. All these birds subsist more or less exclusively on fish. A single cormorant has been ascertained to eat about 14 lb. of fish per day. Painted Storks, by virtue of their larger size, presumably need a larger quantity. Young birds, moreover, are notorious for the healthiness of their appetite. And considering the multitudes of both adults and young that inhabit the Keoladeo heronry for several months in the year, it is evident that hundreds of tons of fish must be needed to sustain this vast population. Just what tonnage? That is what we are concerned to know. And if the species of fish that go to make these birds are of economic value to man, then so much the worse for Man!

The appendices at the end of the book are not its least interesting or useful part. Appendix A—An introduction to Bird Tracks—is a novel aspect of bird study which I believe is so far practically unexploited except in America. It is good to have attention drawn to it, though one may doubt the practical value of this study since by itself it can scarcely provide adequate clues or precise identification. Appendix C—Outline for Life History Study—is a helpful section and offers a number of suggestions of how an investigation may be carried out. The annotated list of books on various aspects of bird study forms a very desirable adjunct for those not in touch with the more important bibliography.

The usefulness of this well-written volume as a guide to bird watching is unquestionable. The general parts of it are of more or less universal application, but to us here in India much of the value of the book is lost since most of the examples cited are of American birds and American conditions with which the beginner and less serious student are not likely to be familiar. But the potentialities of this sort of epitome are patent, and it is to be hoped that some day one of our own ornithologists will undertake to 'Indianise' the more relevant portions for the benefit of bird lovers in this country, and of Indian ornithology in general. Till that day comes, I would strongly recommend this book to every one who has an interest in birds.

S. A.

## MISCELLANEOUS NOTES.

### 1.—A TIGER'S RECORD AS A 'CATTLE KILLER'.

A tiger, which came to be known as the 'phantom' tiger, for until the day it was shot, it was neither seen nor located, was finally shot on the Billigirirangans (S. India) on July 11th, 1945—a male 9' 5" in length—in prime condition. This tiger invariably killed cattle or cart-bulls *inside their sheds or kraals* at night—never on their grazing grounds.

Its activities comprise :—

1. 2 buffaloes	10. 2 cows
2. 2 cows	11. 1 cow
2 cart-bulls	12. 1 cart-bull
Separate sheds—same night	13. 1 cow
3. 2 buffaloes	14. 3 cart-bulls
4. 2 cows	15. 3 cows
5. 1 buffalo	16. 4 cart-bulls
6. 2 cows	17. 1 cart-bull
7. 3 cows	18. 2 cows and 1 buffalo
8. 2 cows	19. 1 cart-bull
9. 2 cows	20. 4 cart-bulls.

Only in three cases did the tiger attempt to make a meal off its kills. Only in two cases did the tiger return to its kills the second night: the latter occasion ending its exploits.

Its head, neck, back and flanks were scored with scratches from forcing its way through the barbed wire fences.

HONNAMETTI ESTATE,

ATTIKAN P.O.

via MYSORE, S. INDIA.

10th September 1945.

RANDOLPH C. MORRIS.

### 2.—CALLING UP TIGERS.

I have read Corbett's 'Man-Eaters of Kumaon', a review of which appeared in the April 1945 issue of the *Journal* of the Society.

Commenting on Corbett's ability, by use of his vocal chords alone, to successfully summon tigers of both sexes to his vicinity, the reviewer remarks that in South India a mechanical contrivance is used to call up tigers.

This refers no doubt to the earthenware chatty, the mouth of which is tightly covered by a parchment-like skin, and the sound

produced by pulling of a string, fastened to the inside of the parchment and passed through a hole in the base of the chatty. I have not myself seen this contrivance in use, but have personal experience of the vocal calling up of a tiger which will be of interest to the readers of the *Journal*.

While after sambar on the Brahmagiri Hills of Southern Coorg, my shikari (a *kurumba*) and I saw a tiger disappearing down a grassy slope, into a shola.

The shikari asked me to sit down near him below the crest of the hill. He cupped his hands together, placed them to his mouth. The sound was *Uh—h—h—ug! Uh—h—h—ug!* repeated two or three times. This struck me as so ridiculous, that I put my head down and shook with laughter—silent of course. An elbow jabbed my ribs—I raised my head—there, 75 yards away and twenty-five from the shola was the head of the tiger. He had come back to investigate the call. This investigation cost him his life.

Later on this same shikari took a planter out shooting. They heard a tiger in a shola. The shikari called, imitating a tiger's voice, but the animal did not walk straight towards the call. He came from behind the men and stopped a few yards from them. Something made them look round just as the tiger was perhaps about to attack them. This tiger also was killed.

I find there is in the *Journal* of the Society, Vol. xxxiii, page 696, an account of the decoying of a tiger by a tea planter. Two tigers had been frightening ponies in the stable near the house, and on the second night of his attempt to get a shot at the animals he heard them calling some three hundred yards away and started to imitate. In this way he got the male animal within a few yards of his verandah and killed it by aid of torch on his rifle.

Except for this record there does not appear to be any account in the Society's *Journals* of the calling up of a tiger by the human voice. There is an Editor's foot-note to the above that in Burma tigers have been known to be attracted to the concealed gunner by the peculiar bleating noise produced by blowing on a leaf held edgeways between the palms of the hands; a dodge commonly employed by the Burman pot-hunter for calling up Barking Deer and Sambar to be slain.

BANGALORE,

24th July 1945.

W. F. RULE.

### 3.—THE SENSE OF SMOEL IN TIGERS.

I only received the April number of the *Journal* a few days ago, or I would have written earlier to give my experience of the tiger's sense of smell, which does not accord with H.G.H.M.'s

## MISCELLANEOUS NOTES

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opinion. Elsewhere I have told the story of an incident which took place while I was a guest of that good sportsman, Dr. C. W. Quinn, civil-surgeon of Damoli, C.P. He sent me to sit over a kill by a tiger described by Fateh Khan—a highly experienced shikari—as ‘a very wise and wily one, and one who would never return to a kill if there were any suspicious circumstances to warn him of lurking danger’. When Fateh Khan and I eventually found the kill, there were no trees in which a machan could be contrived, so Fateh Khan did what he could in an overgrown shrub. To cut a long story short, the tiger came about 4 p.m. and sat down underneath me, so that I could only see his tail by looking over my shoulder. After an appreciable time, he began to sniff, his inhalations growing louder and louder, and his back coming into view from the root of his tail upwards, as he gradually leant further and further back, until he eventually looked into my face—I can assure you his was unpleasantly close to mine, when he spat at me exactly as a domestic cat does, and dashed off under the low brush cover. May I add as a postscript, what a joy the *Journal* is to me, and it goes from me to rejoice another retired from India.

CATCOTT,

N. BRIDGWATER,

SOMERSET,

11th August 1945.

ARUNDEL BEGBIE,

Lt.-Colonel.

[It is commonly maintained that a tiger hunts with his ears and eyes and makes little use of an enfeebled sense of smell. We know little as to the extent to which nocturnal animals rely on vision in getting their food. It is probable that all the tiger's senses play their purpose in its life—the predominance of any one of its faculties depends upon the individual and equally upon the factors in the environment which are then influencing its action.—Eds.]

## 4.—A LEOPARD ‘POOKING’.

The following account of an experience of mine may be of interest.

Some time ago I sat up in fairly heavy virgin forest over a small bullock killed by a leopard. The kill was lying in a track cut through the undergrowth and was thus well exposed.

I got up into my shikar chair about 4.30 p.m. and in about half an hour spotted a big male leopard circling around in the undergrowth on my right. However he did not come out to the kill and gave no chance of a shot. He then moved out of my view.

Just at dusk I spotted him on the track about hundred yards away where he was more or less silhouetted against the afterglow in the sky, but too far away for a sure shot in the tricky light.

The animal seemed to moan or sniff about for a time, and then squatted down in the usual cat manner and defaecated, of course this act was not distinctly visible, but the signs were there when I examined the place later. Now comes the interesting part, after defaecation he moved forward a few paces in a stiff legged manner, and then let out a very high pitched cry, almost a squeak, best described as a 'pook' and at the same time stretched out and seemed to shake one of his hind legs, then a step forward, another call and a shake of the other leg. In all he made this call five times.

I have heard of tigers making this 'pook' call but never of a leopard, and I shall be very interested to hear if anyone has had a similar experience?

Finally I did not manage to shoot this beast, though he came on to the kill well after dark, as, on my switching on my torch he leapt into cover like a flash. I sat tight and after a short time, back he came and was off again on the switch of the light. A third time he came and on this occasion I allowed him to feed for about fifteen minutes (the kill was well pegged down) before taking up the rifle, first pressure taken on the trigger, but it was no use, he was off like lightning and for good this time.

I was once stationed for four years on a garden absolutely infested by leopards, where I saw and shot many of them, but never heard such a cry. The lightning reaction to the torchlight is also quite out with my previous experience.

Altogether a very interesting beast.

POWAI T.E. & P.O.,

U. ASSAM.

T. E. H. SMITH.

12th August 1945.

[The peculiar call of the tiger described popularly as 'pooking' is interpreted by some observers as a mate call. But it is indicated that the call has been frequently uttered as a direct result of disturbance by human agency and as such is probably an expression of surprise, suspicion or alarm. This call is not commonly observed among panthers.—Eds.]

##### 5.—NORTHERN LIMITS OF THE RUSTY-SPOTTED CAT (*PRIONAILURUS* .R. *RUBIGINOSUS* GEOFF.)

In the new *Fauna* the paragraph on the distribution of this cat reads 'Southern India' and there is reference to one specimen taken at Khandalla by Phillip Gosse.

It might be of interest to record that on the 2nd Feb. 1941 I shot one near Suriamal on the Wada road about 70 miles north of Bombay. This cat appeared to be fairly common in that area as we had seen them several times before when motoring

## MISCELLANEOUS NOTES

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through at night, but had mistaken them for stray domestic cats from nearby villages.

While I hope to obtain more specimens when travelling becomes easier, I might mention that another cat shot in the same area a few weeks later has been identified as a domestic cat, though a few spots on its flanks suggest that it may have a strain of this or some other wild cat in its origin.

MESSRS. FAIZ & Co.,  
75, ABDULREHMAN ST.,  
BOMBAY, 3.  
12th July, 1945.

HUMAYUN ABDULALI.

## 6.—SAMBAR 'SWINGS'.

I wonder whether any members have seen—and, if so, can explain the purpose of—the Sambar's *jhoola* (swing). Whatever the purpose, I think it will explain a fairly well known superstition of the jungle people, concerning that deer.

In the month of January, but many years ago, I was shooting from a camp, which I was obliged (from the lack of fresh water) to pitch close to a small wayside station, Bahilpurwa, on the Jhansi-Manikpur line; with Manikpur the next station to the south and Karwi on the north. For a few miles northward from Bahilpurwa was a dense belt of thorn (Ber) Jungle, interspersed with trees and harbouring most of the game in that block—bear, sambar, chital, a few chinkara, in the thinner portions, and a few roving panther (though sambar were plentiful, tiger had not been there for about 10 years then—the dense thorn might explain this, for it held many small herds and solitary stags). On the east of the thorn belt and as far as the railway was tree jungle—some of which was being felled. Westwardly, the thorn gave to more open tree jungle—which contained a 'famine tank', close to the thorn belt. Roughly eastward of the 'tank', and near to where a straggly nullah seemed to separate the thorn from the tree jungle on the east, was a small glade where I saw one definite '*jhoola*' and two other, seemingly, attempted ones. A local villager had guided me to that glade to show me a 'soiling pool' in it; this was drying up then, but had not caked or crusted over and the mud, still boggy, showed signs of very recent use—the innumerable, short, curly hairs in it proving the user to be a sambar. The Indian then directed my attention to the broad trunk of a banyan tree at the edge of the glade and, when we arrived there, pointed at a thin branch overhead, saying repeatedly '*jhoola*'.

What I saw was this: Upon the trunk of the banyan, facing the glade, were blobs and smears of moist, as well as dry, clay—the bark bearing reddish abrasions and scorings in many adjacent places—up to a height of about 5 feet. A couple of feet above this the trunk forked to right and left upwards, the large right

arm (the one to my right) of the fork showing similar signs for a little way along it. This arm passed closely behind a seemingly dried up tree of another species, which grew about a yard away and had a curious twist to it all the way up and extending to its few branches. The lowest of these grew widely into a Y, the lower arm of which jutted out almost horizontally towards but diagonally away from me as I stood facing both trees. This narrow branch bore smears of clay too. The ground in front of both trees was pitted with the tracks of sambar.

Climbing to this thin branch (7 inches circumference, spanned by finger and thumb) and, closely examining it, I found that most of the clay was on its top and outer sides and that adhering to it were many of the short, curled hairs that grow below the 'burr' of a sambar's antlers; and in a few places I saw that the bark had been worn through to the wood, which showed the smooth polish of repeated friction.

Dropping to the ground I sought a means for measuring the height of that branch and my 12-bore, with its 30-inch barrels, best served the purpose; for, by holding it so that thumb and forefinger exactly encircled the line of the breech, and drawing down my shoulder to its limit, I was able to fairly scrape the branch with the muzzles—wearing then low-heeled crepe soled shoes. As my own height is exactly 72 inches, the height I thus reached to would be 120 inches, roughly—10 feet. Incidentally, the circumference of the trunk was, by spanning roughly, about 78 inches. That such a narrow branch had borne the weight of a full-grown stag—for some rakes in the soil below suggested that he must have swung—I could ascribe only to the spiral twist in the wood. What amazed and still puzzles me was that the signs indicated that, instead of merely rearing up against the large tree with his forefeet and then craning backwards to hook his antlers over the small branch, the stag had preferred to do so by reaching under and engaging it from the far side—and had succeeded!

At two other banyan trees, some distance away at the edge of the glade, the stag (or stags) had attempted to do the same thing. At one the attempt was quite tentative—merely hoof marks on the trunk. At the other—a tree, almost similar in shape to the first—the hoof marks went up to the fork (about 5 feet), then a little further along the arm to the right; here, at about 7 feet, it formed a narrow and steeply inclined Y—and the stag had tried to engage the lower arm from beneath and beyond! Had he succeeded, I am sure he'd have had the greatest difficulty in disengaging. Or, was he thus trying to shed his antlers? The signs on those trees were fairly fresh and the month was January. The several stags I saw there carried good heads of hard horn, but only one showed very bleached tips.

HOSPITAL SHIP 'MELCHIOR TREUB',  
C/o BRITISH FLEET MAELS,  
INDIA.

8th July 1945.

K. BOSWELL,  
Capt., I.A.M.C.

[Commenting on the above Note Col. R. W. Burton writes:—

Sambar stags are very fond of rubbing their horns against trees long after the horns are hard and all the velvet has disappeared. In many cases the beam, for some inches above the brow-antlers, is polished quite smooth from the habit. This would account for 'the bark worn through to the wood which showed the smooth polish of repeated friction' observed by your correspondent.

In most forest tracts of Central India and the Central Provinces the story, 'myth' it can be styled, that sambar have the habit of swinging by their horns is widely believed and related by the jungle tribes, Bhils, Gond, Konds, Korkus. I have often had a tree pointed out to me as being one used by Sambar for the 'Jhoola' practice (Hindustani, *Jhoolna*, to swing).

Dunbar Brander, at page 178 of this book 'Wild Animals in Central India' describes what he terms 'preaching' by Sambar stags and has 'seen the stag's antlers become entangled in the overhanging bough, and this no doubt has given rise to the story that they swing by their horns'.

I never met a jungle man who could say that he had witnessed the swinging. It is no doubt a myth, like some other jungle beliefs, with some sub-stratum of truth as foundation for the story.—Eds.]

#### 7.—THE DISTRIBUTION OF THE THAMIN (*PANOLIA ELDI*).

In his article on the 'Larger Deer of British India' in the *Journal of the Society*, Vol. xliii No. 4 of April 1943, R. I. Peacock gives the distribution of *Panolia eldi* as 'Manipur, Burma as far South as Tennasserim probably at least the Northern parts of the Malay Peninsula, Siam, Annam, and Hainan'.

Although Burma naturally includes Arakan there is no mention of any specimens ever having been obtained from that District or from that part of Eastern Bengal with which it marches.

I was surprised to come across Thamin during the recent campaign in Arakan on two or three occasions. My attention was first drawn to the presence of this species by Lt.-Col. Edgerly of the Civil Affairs Service, and late of the Burma Forest Service, a keen naturalist who knows the Thamin well, and thought it strange to find it on the west coast.

I never managed to shoot one, and personally saw only two, both adult males, and in the winter only.

One of the locals had caught a young female and had it as a pet in his village.

They seem scarce and very local and confined to the low ground and coastal foothills on either side of the Indo-Burma border where the country in winter is dry, and the jungle scrubby and open, with grassy hillocks, 'kunai' grass growing on the foothills.

The southern limit in Arakan seems to be MAUNGHNA MA about 10 miles North of MAUNGDAW.

How far North does it extend?

It certainly occurs in the open foothills 15 miles N-E of Cox's Bazaar where I have seen it twice. I found some Chittagonian villagers and local shikari knew it, but all said it was scarce. The Kumis and Moros who lived higher up had never heard of it.

Villagers said they never saw them in the monsoon, but the monsoon is so heavy that villagers do not get about much at that time. Is it possible that the Thamin migrates over the Yomas from the east in the dry season? On the other hand the doe in captivity in the village of Maunghnama was taken as a fawn in October 1943.

I hope someone will secure a specimen in order to ascertain whether there is any deviation from the type.

MAIN HEADQUARTERS,

15 INDIAN CORPS,

11 A.B.P.O.

20th June, 1945.

A. F. PHILIP CHRISTISON,

*Lt.-General.*

# 8.—A NOTE ON THE PRESENT DISTRIBUTION OF THE SUMATRAN RHINOCEROS (*DICERORHINUS SUMATRENSIS*) IN THE ARAKAN DISTRICT OF BURMA.

(With a map).

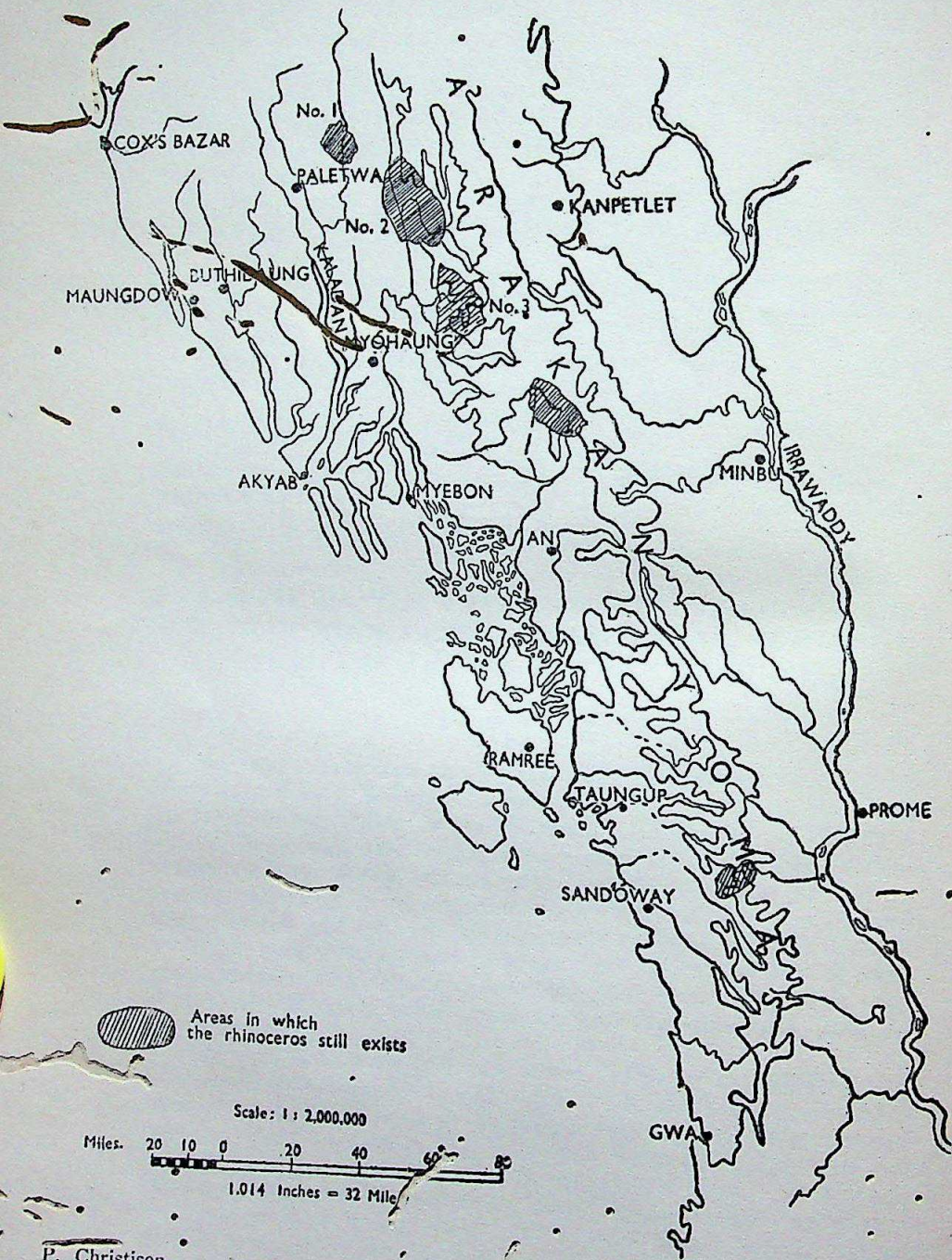
The recent campaign in Arakan from the autumn of 1943 till May 1945 offered a unique opportunity for trying to ascertain the present distribution of the Sumatran Rhinoceros in this District. Throughout this period I had special patrols, usually consisting of two British officers with some local levies and interpreters, operating in the Arakan Yomas east of the Kaladan and Lemro rivers, and later all the way south to the Sandoway Yomas. I briefed these officers, and they sent me regular reports of their observations. Unfortunately none of them were naturalists, but they produced much useful material, and this note is a collation of their reports.

Visual records were very few indeed. During the whole period only three were seen by British officers. In addition, tracks were seen at rare intervals, and droppings and wallows were pointed out by locals. On only two occasions were tracks pointed out as belonging to a cow followed by a calf. However, local tribal headmen who were consulted by patrol leaders knew the animal well where it existed, while others were quite definite either that it had never been known in their area, or that none had heard of it in their lifetime, though it used to be known there.

As these patrols moved continuously in the Yomas, and as I was constantly asking them about rhinoceros, I got a pretty



Journ. Bombay Nat. Hist. Soc.



Present distribution of the Sumatran Rhinoceros (*Dicerorhinus sumatrensis*) in the Arakan District of Burma.

## MISCELLANEOUS NOTES

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comprehensive picture of its present distribution, but a very vague one as regards numbers.

The accompanying sketch shows the areas where this species undoubtedly still exists.

As regards the three actually seen:—

No. 1 was seen in January 1944 about 70 yards away in a sandy wallow in a rocky gorge. On getting wind of the party it dashed into thick cover, and from the noise apparently made straight up the hill side.

No. 2 was seen in the early morning in April 1944, standing near a stream 100 yards away. When the officer crawled up nearer to observe it he heard it make off, and never got a second sight of it.

No. 3 was surprised on a game path on the spine of a bamboo covered ridge. It wheeled round and made straight back up the path. This was in March 1945.

All these were seen by different officers, and all the officers were quite definite that the animal only had one horn. I do not accept this as indicating *sondaicus*, as this species is probably extinct in Arakan and does not haunt the hill crests like *sumatrensis*. The posterior horn is not likely to have been noticed by untrained observers.

MAIN HEADQUARTERS  
15 INDIAN CORPS,  
11 A.B.P.O.  
24th July 1945.

PHILIP CHRISTISON,  
Lieut.-General.

### 9.—THE TAMIL NAME OF THE INDIAN PANGOLIN (*MANIS CRASSICAUDATA*).

On page 233, vol. 45, Miscellaneous Notes—6 of the *Journal* of the Society, Mr. R. W. Stoney refers to the Tamil name of *Manis crassicaudata* as 'Arrunkku'. The name by which the animal is very commonly known in the Tamil Districts of Trichinopoly, Tanjore and Madura, is 'Alungu'. In other places it is called *Kalundu* 'Kadhumdu'.

*Udumbu*, as he rightly says, is the Tamil name for the Monitor Lizard—*Varanus* sp.

STATE MUSEUM,  
PUDUKKOTTAI (S. INDIA).  
3rd July 1945.

K. R. SRINIVASAN, M.A.,  
Curator.

### 10.—NOTE ON THE INDIAN PANGOLIN (*MANIS CRASSICAUDATA*).

(With a plate).

I obtained a male Pangolin on 6-7-45. It had been seen two or three days previously floating in the floodstream of the Mutha River at Poona. It rapidly became very tame; it appeared also

to become accustomed to being taken out in daylight. My observations of its behaviour conform with the account given in Sterndale's 'Mammalia of India'. In addition however observations were made on its mode of digging. When put in an opened termite nest it would set to work unembarrassed by spectators.

First it would sniff around, moving its snout rapidly from place to place and making an occasional tentative scratch with a forelimb. When it had selected a spot it would begin to dig making a few scratches with each forefoot alternatively. The rapid sniffing continued all the time, as the hole began to appear. As it progressed it would sometimes change direction, the animal appearing to be guided by smell. If it started working sideways or upwards it would turn over onto its side or back as the case might be, and continue to dig in these positions.

Photograph No. 1. shows it working on its side. The hind legs were then frequently applied to the walls or roof of the hole to obtain a better purchase. When the hole was well advanced it would periodically back out to eject the excavated earth. The actual ejection from the mouth of the hole was performed in two movements. First the hind legs were planted firmly astride and by a rapid movement of the whole of the forepart of the body (as when curling up) the earth was shot between the hindlimbs. This is shown in photograph No. 2. the part of the body in rapid motion at the moment of exposure (1/50 sec.) can be seen to be blurred. The downward curve of the tail was caused by the fact that tip caught the ground as it moved backwards. Secondly the forelimbs are planted on the ground and a vigorous backward thrust is made with the hindlimbs together. The animal then returns down the hole until the next load is ready to be shifted.

When it struck one of the combs<sup>1</sup> in the nest, the digging would cease whilst the ants are eaten. There were however many ants still in the remains of the comb when ejected.

For about six weeks it was fed on white ant combs and condensed milk. In its box it would start on the combs as soon as it smelt them, and sniffing continually, turn over the bits of comb with rapid strokes of its tongue. The worrying action of the tongue crumbled up the comb. I was puzzled by the fact that it did not appear to pick up any of the actual comb, on its sticky tongue. It would sometimes lick my hands if I had been handling combs, the tongue did not feel sticky.

On this white ant diet, its faeces were a bright straw yellow, and the consistency of half set jelly, they were squirted out in one action, they always appeared to contain some membrane.

With a view to accustoming it to a change of diet in preparation for a journey, the white ants were stopped, and it was fed on milk alone for ten days, and then on milk and custard.

Four days after this it died (31-8-45). The cause of death was not known; there was a fair amount of fat in the tissues

<sup>1</sup> Fungus gardens.—EDS.



1. The Indian Pangolin.



Photos by

G. UNDERWOOD.

2. The Indian Pangolin.



so evidently it had sufficient food; the stomach was nearly empty, so evidently also it was able to digest its food.

I send a tube of ticks preserved in spirit, some of them were found round the anus, but the great majority were found under the scales which provided ideal shelter. I noticed that the ticks were quite willing to bite me. I hope you can identify them.

No. 1. LIGHT SCOUT CAR FIELD PARK,

A. B. P. O. W.

GARTH UNDERWOOD.

9th September 1945.

## II.—WHISTLING THRUSH (*MYOPHONUS CAERULEUS*) PREYING ON OTHER BIRDS.

The other day while watching a pair of Whistling Thrushes (*Myophonus caeruleus*) in Naini Tal and trying to locate their nest, I noticed one of them fly down on to the ground when it was immediately attacked by several angry small birds, chiefly the dark grey Bush Chat. The Thrush appeared from the long grass with something large in its beak which at first I took to be a large slug, but soon saw it was a young bird, fully fledged. The Thrush flew off on to a boulder and beat the small bird to kill it and then flew away with it in the direction of its nest. I never found this nest because it was built on the side of a particularly poisonous drain and I could not bear the smell long enough to stay and watch.

Could you tell me if it is usual for this Thrush to kill young birds; it seemed to me not very characteristic of it; it could not possibly have fed its own young with the bird it had killed.

1/29 PRITHVIRAJ ROAD,

NEW DELHI.

Mrs. A. B. M. WAY.

24th June 1945.

[While Whistling Thrushes (*Myophonus*) are ~~carni~~ vorous in the sense that they eat worms, insects etc. they are not usually given to feeding on other birds: an individual may however acquire such a habit as a development of its carnivorous appetite. A Whistling Thrush in captivity was seen to kill and feed on a mouse which entered its cage. Eds.]

## 12.—BLACK-CAPPED KING FISHER [*HALCYON PILEATA* (BODD)] NESTING IN INDIA.

My brother, Shamoon, was touring Mysore this year, when (3th May) he found a nest of this Kingfisher in the banks of the Sheravati River at the ferry just above the Bersoppa (Jog) Falls. The nest was about 3' deep and contained 2 newly hatched young and two eggs.

This is a Chinese species, and though it straggles up the coast of Western India, as far north as Bombay during winter,

the only nesting record from India is Stewart's (Nidification iii, p. 423), who took four eggs from a hole in the bank of a small river in Travancore forest. Nests have been taken in Burma and at Bangkok, but though fairly common in the Malay Peninsula, the next nesting records are from Hongkong and Foochow.

MESSRS. FAIZ & Co.,  
75, ABDULREHMAN STREET,  
BOMBAY.

HUMAYUN ABDULALI.

19th June 1945.

### NOTES ON THE BEHAVIOUR OF NESTING PADDY BIRDS (*ARDEOLA GRAYII*) IN KASHMIR.

(With two plates).

The Paddy Bird, Pond Heron or Blind Heron has had the good fortune of being rescued by 'Eha' from a somewhat drab obscurity with a sparkling phrase.<sup>1</sup> The bird is not uncommon in Kashmir where it breeds in the Vale in some numbers, nesting by or above water usually in willow trees. The main facts relating to its nidification are already well-known and need not be recapitulated here, although some notes elicited by a spell of watching the breeding bird in Kashmir this summer (1945) may be of interest.

During the breeding season, the Paddy Bird is by no means the 'silent bird' of Mr. Stuart Baker's *Fauna of British India*; instead, in the vicinity of its nesting site, it keeps up an incessant talking. A favourite call is a contented 'huh' varied with a sort of asking sound, a duo-syllabic 'yuck-kuck' like old men exclaiming in weak voices. In its breeding plumage, the Paddy Bird is extremely handsome, the head, in both sexes, developing a long pointed white crest; while the back is adorned with decomposed feathers of a rich maroon colour. Both crest and back feathers are used in display as will be described hereafter. The young, especially when clamorous for food, are also noisy keeping up a continual 'chick-chick-chick', a noise uttered by the young of other members of the heron tribe. A great part of the time is spent by the adults and the more grown-up young in a careful preening of the feathers principally of breast and wing. Both young and old, like the Darter, habitually vibrate the throat, the action having the effect of a pair of bellows which blow the small feather adhering to the mandibles from constant preening, gently and fluttering in an outward direction.

<sup>1</sup> In his *Common Birds of Bombay*, Eha writes of the Paddy Bird, it 'is little persecuted and grows very familiar, allowing you to approach within a few paces before it suddenly produces a pair of snowy wings from its pockets and flaps away'—Eds.



Fig. 1. "*Asking for more.*"



Photos by

W. T. LOKE.

Fig. 2. "*— and yet more.*"



Fig. 1. Greeting display by Paddy Birds.



Photos by

Fig. 2. Paddy Bird sheltering chick from sun.

W. T. LOKE.

Due to the presence of crows (*Corvus s. rugmayeri*) near the nest I was observing one parent, even when the chicks were almost ready to fly, remained always on guard. Errant crows or returning parents were greeted in a similar fashion; the crest feathers were raised and spread, the breast and back feathers fluffed out and shivered. (See fig. 1, Plate II). In addition, in the greeting ceremony, the birds welcome each other with cries, the parent on guard rushing up to the returning bird as though to drive it off. When they get near, defiance gives place to the endearments and the birds will caress and nibble the feathers of one another's neck.

The young birds, when they are large enough, demand food from their parents in a most curious fashion. In this connexion I should like to refer the reader to Lt.-Col. R. S. P. Bates' article in the *Journal* (Vol. 44, pp. 179 seq.) describing a similar display in the case of the Little Bitterns (*Ixobrychus minutus*). The bill of an adult is seized by a youngster in its own mandible; and vigorously twisted, the head of the former being sometimes forced to the level of the floor of the nest. (See figs. 1 and 2, Plate I). That the adult does not enjoy this kind of treatment is proved by the attempts (not always successful!) to escape filial attention by stretching the telescopic neck to maximum extension. When the young become too importunate, the adult will leave the nest and seek quiet on a distant branch of the family nest-tree. When the bill of the parent is out of reach, the young practise their 'asking-for-more wrench' on the twigs or branches. They will also bill-wrestle with each other. The young are fed by regurgitation, the parent depositing food on the floor of the nest and this is seized with avidity by the hungry youngsters. On one occasion I also saw a young bird, an hour after it had been fed, bringing up two pieces of fish which were then picked up and eaten by one of its three brethren. The bill does not appear to be much used by the young as an aid in climbing, although when caught for ringing they invariably seized their feet in their own mandibles.

Fig. 2, Plate II shows a parent sheltering a chick under its wing from the heat of the sun.

BOMBAY.

W. T. LOKE.

22nd September 1945.

#### 14.—ON THE OCCURRENCE OF THE CLUCKING TEAL (*NETTION FORMOSUM*) IN THE MONGHYR DISTRICT.

Stuart Baker notes in his 'Game-Birds of India, Burma and Ceylon' that the occurrence of the Clucking Teal (*Nettion formo-*

sum) within Indian limits is of the rarest. It may therefore be of some value to add to the known record of its occurrence in India. A male of this species in full breeding plumage was shot at Simri Bakhtiarpur in the north of the Monghyr District in the winter of 1937-38 by Mr. Krishnanand Sinha, Proprietor, Banaili Raj. The stuffed skin is now in the Patna Museum.

CHHAJJUBAGH,  
PATNA.

D. E. REUBEN.

30th June 1945.

15.—RECORD CLUTCH OF EGGS OF THE WHISTLING  
TEAL [*DENDOCYGNA JAVANICA* (HORSE.)]

While climbing up into a Banyan (*Ficus bengalensis*) tree to get a shot at a mugger in a village tank (Sandhana, Kaira Dist.) on September 1st 1945, I found a Common Whistling Teal (*Dendocygna javanica*) including a clutch of seventeen (17) eggs. Though the Whistling Teal is common in Kaira District this happens to be the only nest I have found of this species; so I cannot say what the usual number of eggs in a clutch is in this district. However on looking up the matter I find the following information:—

Stuart Baker—6-8 eggs. In Punjab and Western India 10-12 common. Assam 4-5.

Whistler—8-10 ' . . . though more or less are often laid'.

F. Finn—'About a dozen white eggs are laid . . . '.

Salim Ali—'Seven to twelve eggs form the normal clutch, the commonest number being 10'.

I am fairly certain that only one bird laid these eggs, as when I fired at the mugger, the duck off the nest, joined by its mate, were the only two Whistling Teal to be seen flying around the smallish tank.

METHODIST HOSPITAL,  
NADIAD, GUJARAT.

9th September 1945.

H. C. ALDRICH,  
Surgeon-in-charge.

[Stuart Baker (Nidification of the Birds of the Indian Empire, Vol. iv, p. 501) says that the normal clutch is eight to ten which agrees with the estimates of many observers but occasionally exceptionally large clutches are laid. He had one record of sixteen and two clutches of twelve and fourteen, both of which appear to have been laid straight on end by one and the same bird.—EDS.]



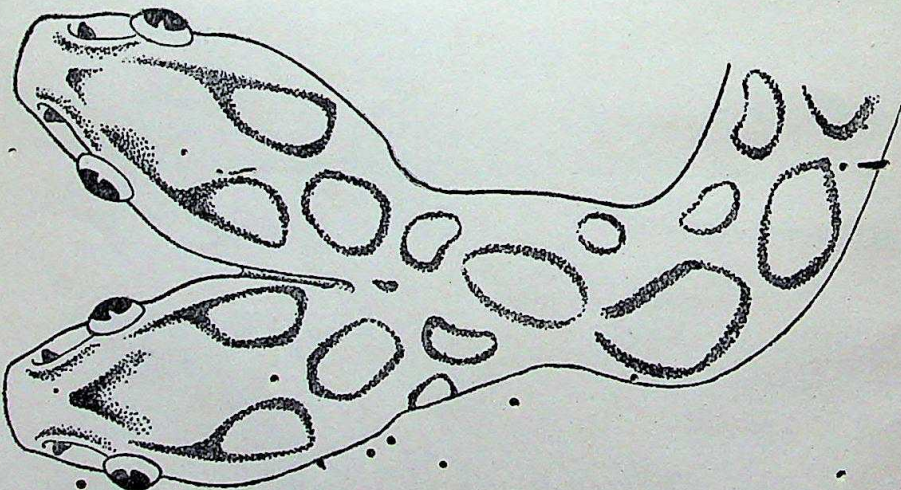


Fig. I. Dorsal view of the head of abnormal *Vipera russelli*.  $\times 3$ .

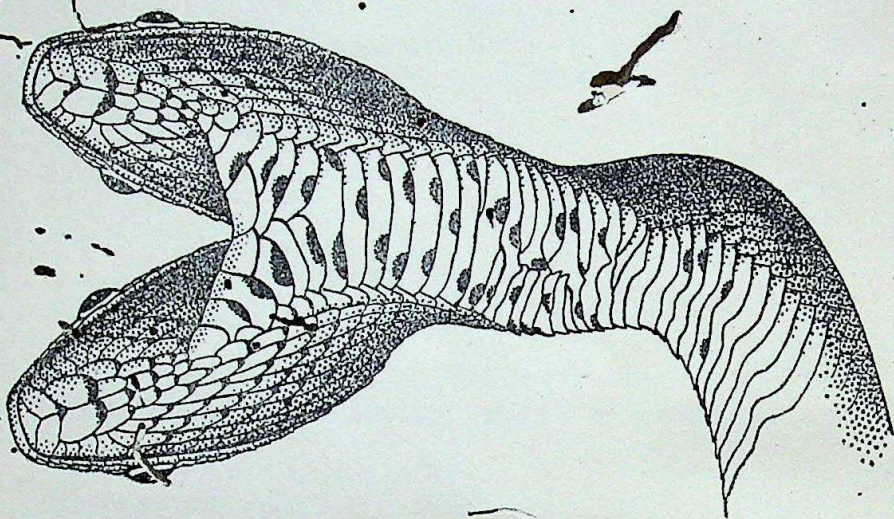


Fig. II. Ventral view of the head of abnormal *Vipera russelli*.  $\times 3$ .

16.—AXIAL-BIFURCATION IN [*VIPERA RUSSELLII* (SHAW)] FROM BENGAL.<sup>1</sup>

(With a plate)

Though there are many authentic records of the occurrence of double-headed snakes from different parts of the world, only three such specimens appear to have been recorded in India so far. Dobson<sup>2</sup> reported, in the form of an abstract, cases of anterior dichotomy in two specimens of *Lycodon aulicus* (Linn.) and *Naja tripudians* Merr., belonging to the Indian Museum. The third record is by Wall<sup>3</sup>, who gave an excellent account of the abnormality in the cephalic region of a juvenile specimen of *Lycodon aulicus* (Linn.), found in the Fyzabad Museum. He remarked: 'It is perhaps not so well-known that the genuine double-headed snakes do occur occasionally as freaks, but in these instances both heads are always attached to the anterior extremity of the body constituting what is technically called anterior dichotomy'.

Among various kinds of abnormalities, Johnson<sup>4</sup> recorded over a dozen instances of dicephalic condition found in snakes, picked up from the various museums of America, and tried to explain this abnormal condition with the help of skiagrams.

Recently Cunningham<sup>5</sup> has reviewed the published literature on anterior dichotomy or axial-bifurcation in snakes and has given the geographical distribution of the abnormal specimens as follows: North America 76, Central America 4, South America 5, Europe 31, Asia 10,<sup>6</sup> Australia 2, Africa 3 (Total 131).

The specimen of *Vipera russellii* that forms the subject of the present note is in the collection of the Zoological Survey of India. It was caught at Tarakeswar in the district of Hooghly, Bengal, and was purchased in May, 1929. It has been kept in alcohol over a period of 16 years, and has turned hard and unfit for any anatomical investigation. It is 216 mm. in length and is no doubt juvenile. The maximum length of the species so far recorded is about 5 ft. 6 inches. (Brook-Fox).<sup>7</sup> On account of the present condition of the specimen and lack of facilities for X-ray work, it has been possible to make observations on external characters only.

In order to study the changes in the general form due to dicephalic condition, the abnormal Russell's Viper (Fig. 1) has been compared with a normal specimen of the same species and of almost the same length. In the abnormal specimen the heads have undergone no change in shape etc., but the scales appear to be

<sup>1</sup> Published with the permission of the Director, Zoological Survey of India.

<sup>2</sup> Dobson, G. E., *Proc. Asiat. Soc. Bengal*, pp. 23-24 (1873).

<sup>3</sup> Wall, F., *Journ. Bom. Nat. Hist. Soc.*, XVI, pp. 386-388 & 752-753 (1905).

<sup>4</sup> Johnson, R. H., *Trans. Wisconsin Acad.*, XXV, pp. 523-535 (1901).

<sup>5</sup> Cunningham, B., *Axial-Bifurcation in Serpents*, p. 68 (1937).

<sup>6</sup> Probably the three abnormal specimens recorded from India have been included under 'Asia'.

<sup>7</sup> Brook-Fox, F. G., *Journ. Bom. Nat. Hist. Soc.*, VIII, p. 565 (1894).

slightly fewer in number than in the normal specimen, as is seen in the following table:—

TABLE I.  
*Scale of abnormal and normal specimen  
of Russell's Viper.*

	Scale counts			Total length
	Ventrals	Mid-body	Subcaudals	
Abnormal Specimen (Reg. No. 20434)	165	29	48	216 mm.
Normal Specimen (Reg. No. 3144)	168	31	52	220 mm.

The slight variation in scale count is within the range of variation as shown by Smith;<sup>1</sup> Ventrals ♂ and ♀ 153-180; Subcaudals ♂ and ♀ 41-64; Scales in the Mid-body 25-29; 27-33; 21-22.

No appreciable difference could be detected either in lepidosis or in the shape and size (Table II) of the heads. Dentition is normal and the poison fangs are developed in both the heads. The two mouths appear to be capable of functioning in a normal way.

TABLE II.  
*Measurements (mm.) and scalation of the right and  
left head of the abnormal and normal specimens.*

	Abnormal head		Normal head
	Right	Left	
Length of head	17	16	16
Breadth of head	9	8	8
Scales between nasal and eye	2	2	2
Scales round the eye	12	14	14
Number of supralabials	10	10	10

The ventral scales up to the 8th are normal, but from the 9th to the 17th they are irregular (Fig. 2) and broken in the middle. There is a slight vertebral projection, but without a skiagram it is not possible to locate definitely the exact point at which the projection has taken place. The projection lies at a distance of 34 mm. from the tip of the snouts.

<sup>1</sup> Smith, M. A., *Fauna Brit. India (Rept. & Amph.)*, III, p. 483 (1943).

Johnson (*loc. cit.*, p. 533), has attached great importance to the 'Degree of bifurcation'. In almost all cases the angle of bifurcation has been ascertained either by dissecting the specimens or with the help of skiagrams. With the specimen under report either of these methods could not be resorted to.

Very little information is available on the behaviour of double-headed snakes. Some authors, as Wall, Fischer<sup>1</sup> etc., observed the behaviour of abnormal specimens kept in captivity.

Heasman<sup>2</sup> who carried out anatomical investigations on a double-headed *Coluber (Zamenis) florulentus* Schlegel, has stated that as 'each head has a complete set of receptor organs, a complete brain and a normal musculature it is reasonable to suppose that the heads, being subjected to different stimuli, will behave independently'.

A very interesting account of the behaviour of a double-headed American hog-nosed snake (*Heterodon simus*), was published in the *Madras Times* in 1897. It was stated that the snake used to feed with the two heads simultaneously, and the heads sometimes fought, and at other times played with one another.

I am grateful to Dr. B. N. Chopra, Director, Zoological Survey of India, for going through the manuscript and for making some suggestions. I wish also to thank Mr. A. K. Mondul, artist, Zoological Survey of India, for the drawings he has made for this note.

ZOOLOGICAL SURVEY OF INDIA,

BENARES CANTT.,

M. N. ACHARJI, M.SC.

3rd August 1945.

17.—ADDENDA AND CORRIGENDA TO 'THE BUTTERFLIES OF THE NILGIRIS' PUBLISHED IN VOLS. XLIV AND XLV OF THE JOURNAL.

ADDITIONS.

*New Species* :—

292. *Pathysa antiphates naira*: Recorded from the Nilgiris in July or August (Sanders).

293. *Appias paulina wardi*: Foot of the Nadgani Ghat in January (Emmet). Several from below Coonoor. (Florence).

294. *Prinoris sita*: Two from the middle of the Nadgani Ghat in July or August. (Sanders).

295. *Colotis amata modesta*: ♀ v. *albina*: Recorded from the Nilgiris by Sanders.

<sup>1</sup> Fischer, E. C., *Scientific American*, LXXV (1896).

<sup>2</sup> Heasman, W. J., *Journ. Anatomy* (Cambridge), LXVII, pp. 331, 345 (1933).

Rearrangement of local *Melanitis*:—

91. *Melanitis leda ismene*.
92. *Melanitis phedima varaha*.
93. *Melanitis zitenius* subsp. nov.
94. *Melanitis tristis* (or *M. phedima* v. *tristis*?)
96. *Melanitis* sp. nov? (or *M. leda* variety?)

In the list the female described was wrongly attributed to sp. *phedima*. It is obvious from further specimens of both sexes caught in August at Walayar, near Coimbatore, that it is *zitenius*, and apparently a very distinct subspecies. (See the description given in the list, the male being very similar but differing in shape. See also illustration in vol. xlv).

On the Mettupalaiyam Ghat in the wet season at the end of the year there is a very common *Melanitis* similar to *M. leda* D.S.F. but larger, brighter above, and more deeply and distinctly marked below. This flies together with *M. leda* W.S.F. In the list this species was attributed, perhaps nonsensically, but by a process of elimination, to *M. zitenius*. In the dry season only the D.S.F. of *leda* apparently is to be found. What is this species . . . a variety of *leda* or a distinct species?

A detailed study of the imagines and larvae of the local *Melanitis* would probably repay anyone who had the time for it.

297. *Nacaduba pactolus continentalis*: Recorded from Wenlock Bridge, Kallar and the Nadgani Ghat in July and August. (Sanders).

298. *Thaduka multicaudata kanara*: Foot of the W. slopes in May and January. Silent Valley in the same months. (Pringle).

299. *Pratapa deva deva*: Below Coonoor and at Kallar in July and August. (Sanders).

300. *Tajuria jehana*: Mr. Wenlock Bridge in July or August on Loranthus (Sanders). Tiger Hill, May. (Rawlins).

301. *Tagiades distans*: Major Emmet pointed out to me that *T. distans* apparently is found in the Nilgiris and is not uncommon. On examining my specimens of *T. obscurus athos*, two from Kallar certainly answer superficially to *T. distans*. Emmet has specimens from the Nilgiris and the Palnis and he informs me that he has examined the clasps of the latter and they answer to the description of the clasps of *T. distans* given by Ormiston in his 'Butterflies of Ceylon'.

302. *Halpe moorei moorei*: Sigur Ghat in December (Emmet).

Local *Padraonae*:—

279. *Padraona cato cato*.
280. *Padraona pseudomaesa pseudomaesa*.
303. *Padraona tropica diana*.
304. *Padraona palnia palnia*.

*Cato* is abundant on the Nadgani Ghat in October. Also recorded from Singara in December and the Mettupalaiyam Ghat in February.

*Pseudomaesa* from Singara in December, *tropica* from the

## MISCELLANEOUS NOTES

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Nadgani Ghat in October and from the plateau. *Palnia* from the plateau.

Additional information on recorded species:—

11. *Papilio buddha*: Mid-Nadgani Ghat in September.
74. *Mycalesis visala visala*: Common at Gudalur in the autumn.
101. *Euripus consimilis meridionalis*: Two females from Kallar. (Sanders).
108. *Limenitis procris undifragus*: Nadgani Ghat in September and July. Silent Valley in May. By the Moyar River in December. (Pringle).
160. *Megisba malaya thwaitesi*: Kallar, 24th July 1945.
183. *Nacaduba helicon viola*: Nadgani Ghat in September.
- (188. *Nacaduba noreia hampsoni*: Major Maitland Emmet caught a good series of these at the foot of the Coolie Ghat in the Palnis in May of this year. This is, of course, outside the Nilgiris, but an interesting record).
193. *Iraota timoleon arsales*: Kallar, July or August. (Sanders). Foot of Nadgani Ghat, May. (Pringle).
194. *Horsfieldia anita dinu*: Near Coimbatore. (Pringle). Gudalur in December. (Emmet).
196. *Amblypodia centaurus pirama*: Kallar, July or August. (Sanders).
200. *Surendra todara todara*: Below Coonoor. (De Nicéville). Nadgani Ghat in July or August. (Sanders).
204. *Spindasis abnormis*: Several records from Coonoor. (Florence).
209. *Pratapa cleobis*: Gudalur Dak Bungalow, below Coonoor, and from Wellington, in July and August. (Sanders).
211. *Tajuria cippus cippus*: Can be obtained on Loranthus below Wenlock Bridge and at Kallar in July and August. (Sanders).
213. *Cheritra fraja jaffra*: Nadgani Ghat in September.
215. *Horaga onyx cingalensis*: Can be caught near Sultan's Battery in January. Local.
217. *Catapoecilma elegans myositina*: St. Catherine's Falls, Kottagiri, in December. (Emmet).
219. *Zeltus etolus*: Nadgani Ghat in September.
227. *Bindahara phocides moorei*: ♂ ♀ Kallar in May. (Emmet).
253. *Baracus vittatus subditus*: Dimbum Ghat in July. (Pringle).

Errata:—

203. *Spindasis schistacea*. 251. *Astichopterus jama mercara*. These are no records of these species: remarks apply to *S. vulcanus* and to *S. pulligo* respectively.
262. *Notocrypta paraiysos alysia*: Hampson's is the only record I can find. My remarks apply to *N. curvifasciata*.

KETTI.

M. A. WYNTER-BLYTH, M.A. (Cantab.)

July 1945.

11—A

## 18.—TWO BURMESE SPIDERS WHICH MIMIC SCORPIONS.

(With 2 plates).

The area of country close to Tongup, Burma is very rich in spiders. During a period of three weeks in that area I collected over seventy different species including the following two scorpion mimics.

These are apparently allied to the Genus *Araneus*, but as I have as yet been unable to identify them the following is an ecological description only. In these numbers the tip of the abdomen is elongated to form a scorpion-like 'sting'. The first two pairs of legs are larger than the hind two pairs, the femur being relatively large. Just as the mimicry of the ant-mimic genera *Myrmarachne* and *Amyclaea* is partially dependent upon the antennae-like waving of the first pair of legs, and by the ant-like movement of the spider, so scorpion-mimicry of these two species is dependent upon the aggressive attitude adopted by the spider when it falls to the ground on being disturbed in its web. Most members of the genus *Araneus* 'sham death' when they fall to the ground, but these two species curl the tip of the abdomen forward over the cephalothorax and hold the first two legs on each side close together, and straight forward, appearing very like the pincers of a scorpion.

Both these spiders spin simple orb webs about eight inches in diameter, which are found under shrubs and trees in a vertical position.

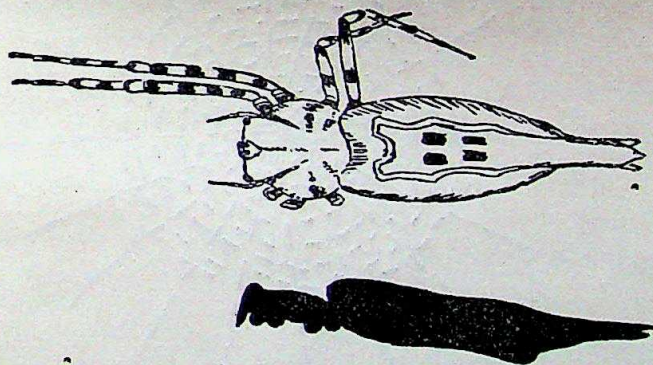
The web of the yellow species is found amongst small shrubs with a yellow flower. When I saw this spider I thought that it was a dried petal hanging in a web. The spider rests just above the centre of its web with its abdomen flat against the webbing, quite un-scorpion like in this position. Dried cast skins and petals are also found in the web providing what Hingston terms 'Decoy Devises' protection. When the web is touched the spider drops to the ground and adopts the scorpion mimic attitude described above. This will give protection due to the apparent rapid change in form just as a rapid change in colour gives 'Flash colouration' protection.

The red species is found beneath trees with very finely divided compound leaves, the dried leaflets of which are reddish brown in colour. These dried leaflets are found in the web as 'decoys'. The spider rests in the centre of the web, the flattened tail being apparently the stem of a leaflet. When the web is touched the spider drops as the yellow species does.

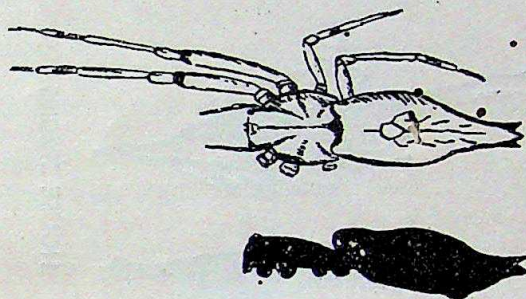
In this area I found many species of *Araneus*, very dried-leaf like in form when they are seen hanging in the web, or more usually resting at the side, but the above two are the only mimetic forms which I have found in Burma.

The mimetic protection obtained by these spiders is due entirely to their scorpion-like form and attitude when on the ground. They do not receive protection because they are found

SPIDER-SCORPION MIMICS



RED LEAF-LIKE SPIDER

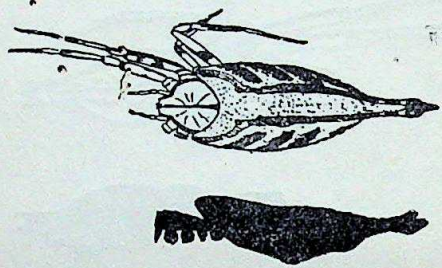


YELLOW PETAL-LIKE SPIDER

1 CM. SAME SCALE

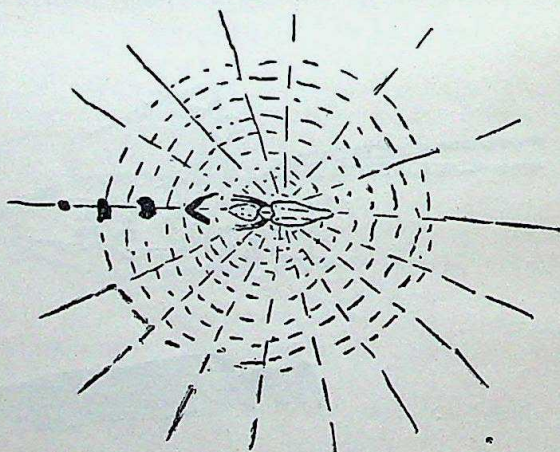
J.E.M. 6/10/26

# SPIDER-SCORPION MIMIC



HOUSE SPECIES

ONE CM. SAME SCALE



WEB WITH COCOON AND DEBRIS

Jan 5/1915

in areas where scorpions are plentiful because I found very few small scorpions in this area.

I would like to amplify this statement with reference to the ant-mimic genus *Myrmarachne*. Around Tongup, the red ant *Oecophylla smaragdina* is very common on the mango trees. The ant-mimic spider *Heplataloedes* is also common on those ant infested trees and is never found on trees without ant colonies. In this case the mimetic protection is two fold, firstly that of similarity and secondly that of living with the ant 'model'. Many other species of *Myrmarachinae*, usually shiny black species, are common in Tongu but I have never found them on trees where a model ant colony exists. There may be a similar ant to be found, but in the field they cannot be 'paired' together ecologically. In these cases as with the scorpion-mimics described above the protection obtained is only half that of the red ant-mimic.

C/O HEAD QUARTERS,  
22ND (E.A) INFANTRY BRIGADE,  
S.E.A.C.  
8th September 1945.

J. E. MARSON,  
F.R.E.S.

P. S.—I have today found another species of scorpion-mimic spider which is to be found in dwellings here in Mawchii. Its web is spun so that it is visible against the sky and a typical position is from the eaves to the supports of a verandah.

The web is usually about eight inches in diameter with about twenty widely spaced radiatory web strands. The spider rests centrally with its abdomen pointing downwards, the first two pair of legs being straight forward and the abdomen tip flattened against the web. The cocoon is spun just above the centre of the web in a position between the spider's first two pairs of legs. A vertical line of widely spaced debris, acting as 'decoy' device continues upwards from the cocoon. The illustrated web (vide fig.) contains in insect's leg and three sets of insect remains.

The spider's abdomen is centrally white with small pink dots and the markings are golden brown standing darker to the sides of the abdomen.

When in the web the spider is difficult to see but when disturbed it moves in the web with the tip of the abdomen curled forward, a position which it continues to adopt when it falls to the ground on a thread.

MAWCHII,  
5th October 1945.

J. E. MARSON,  
F.R.E.S.

Vott, H. B. Adaptive Colouration in Animals (1940).

Hinston. I.M.S. Field Observations on Spider Mimics. P.Z.S. 1927 Vol. IV.

" " Devices in Spider Webs. P.Z.S. 1927 Vol. XVIII.

19.—*CURCUMA PSEUDOMONTANA* GRAH.

*Curcuma* is one of the first plants to show up in Khandala shortly after the beginning of the rainy season, and from its first appearance till well into October it is one of the most showy and abundant plants in the district. For this reason the very deficient and often contradictory descriptions found in current floras are almost inexplicable. I have been observing this plant for the last four years, and it was only after many a day spent in pouring rain that the various difficulties concerning the Khandala *Curcumas* were solved. Through all these years I have often had the company of Mr. C. McCann, who at a moment's notice has always been ready to brave the wettest and muddiest of conditions in Khandala and elsewhere; without his support and company these notes could not have been written.

Cooke (II, 734) when speaking of *Zigiber cernuum* Dalz. makes an interesting remark, which can be fully applied to the various species of wild *Curcumas*: 'The plant unfortunately flowers in July, at which time the whole of the hill-sides are streaming with water, rendering plant-collecting a task of no ordinary difficulty.' The reason for this 'unfortunate' difficulty will be appreciated when it is known that the rainfall in Khandala for the last 15 years has averaged 188.37", with a maximum of 230.90" in 1942 and a minimum of 154.85" in 1932; most of this rain comes between June 15th and August 31st; this is the reason why plant collecting during that most interesting part of the monsoon is a task of no ordinary difficulty. Due to such abundant rain, rocks become covered with slime and soil turns loose and slippery, so that the danger of landing at the bottom of one of the ravines after a very swift journey is a very real danger and is always present during the monsoon.

As a consequence of such difficulties, the material preserved at Kew and other national or foreign herbaria is very scrappy; hence it is that descriptions of the plant such as are found in Cooke's *Flora* or in Schumane's *Zingiberaceae*, etc., are necessarily very incomplete, since they are mainly, if not exclusively, based on preserved herbarium materials. In the following pages I shall try and give as complete a description of the Khandala *Curcuma* as I have been able to gather in four years of intensive study of hundreds of living specimens.

*Occurrence.* *Curcuma pseudomontana* Grah. is one of the commonest plants in Khandala throughout the rainy season; it is particularly abundant about St. Xavier's Villa, on the plateau near Kune Katkari Settlement, on Behram's Plateau and on the top and upper slopes of Bhoma Hill (popularly known as 'The Sausages'); it is rarely to be found in the ravines, except on the upper slopes where the climatic conditions are about the same as those prevailing in Khandala Plateau.

From all these places large numbers of specimens have been collected; often after a day of *Curcuma*-hunting there were as many as fifty different specimens on the tables of our improvised

## MISCELLANEOUS NOTES

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laboratory. Each plant was examined and measured carefully for its height, size of leaves, colour of bracts, etc. After this thorough study of the plant in the living condition, it was conveniently dissected, poisoned and pressed; most of the specimens collected at Khandala are now preserved in the Blatter Herbarium, St. Xavier's College, Bombay.

From the very beginning there were a number of details that seemed to differ considerably from the description given in Cooke's *Flora*. In order to get an insight into the story of the development of *Curcuma pseudomontana*, a square plot of about 20 m. side was marked off with stones in front of and near St. Xavier's Villa. Visits to Khandala and to this 'observation plot' were paid every two or three weeks from June to October; this went on for three years. On the fourth year the plot was found to be too large, and certain anomalies that appeared in some of the plants could not be accounted for. In 1944 a much smaller plot was selected, about 2 sq. m. containing about 5 or 6 *Curcuma* plants. The results obtained from visiting such plots and other places in Khandala amply repaid the trouble taken during four successive years.

DESCRIPTION OF *Curcuma pseudomontana* Grah.

Rhizome conical or cylindrical, about  $6.5 \times 2 - 2.5$  cms. Fibrous roots many, stout (about 5 mm. diam.), up to 20 cms. long but generally shorter (8 - 15 cms.); each root bearing at its end an elliptic or globose tuber of  $1.5 - 4 \times 1.5 - 2.5$  cms. Both the rhizome and the small tubers are white inside in their young stage, or white with a pale tinge of yellow; as they become old, and their starchy contents get absorbed, the colour of the tubers deepens into orange yellow. Rhizome and tubers, when freshly cut, are pleasantly aromatic and taste very strongly of Ginger. The small tubers are formed towards the end of the rainy season and together with the rhizome are the means of insuring the survival of the plant during the dry periods of the year; at the beginning of the next monsoon the plant draws on last year's supplies for its immediate growth and flowering. During August one can see the remains of the old, exhausted tubers at the end of decaying roots, and the beginnings of the new tubers on freshly formed roots.

Generally there is but one aerial shoot from each rhizome; on several occasions, however, we have found two shoots growing side by side from the same underground rhizome.

The leaves come out either *after* the inflorescence spike, or occasionally at the same time as the spike or in very rare cases just before the spike. Generally when the spike is about 10 - 15 cms. high, the first leaf appears above ground, all curled up longitudinally; the unfolding of the leaf is just a matter of a few hours; as the season progresses other leaves appear, so that by the end of the rains there are 5 - 7 leaves per plant.

The size of the leaves varies with the season and the location in which the plant is growing; on exposed slopes near the top of

Bhoma Hill throughout the whole season, or elsewhere at the beginning of the rains, leaves are relatively small; during September and early part of October they attain such large proportions that at a little distance such plants are easily mistaken for wild banana plants. There is in Blatter Herbarium a set of specimens with leaf blade  $69 \times 30.5$  cms., petiole from ground level to leaf base 74 cms. long; the largest leaf collected up to the end of 1944 was 160 cms. long from ground level to tip of leaf.

Leaves are entire, ovate, or oblong lanceolate, acute or shortly acuminate, base acute or shortly decurrent into the petiole; lateral nerves numerous, parallel among themselves and forming a broad angle with the midrib, very conspicuous on both sides of the leaf, which occasionally even appears plaited. Petiole stout, cannelled above; base of the petiole broadening out and forming a sheath which embraces the stem tightly; at the upper part of the sheath there is a conspicuous ligule, which is truncate, membranous, up to 16 mm. broad, 5 mm. long, entire, ciliate at the edges. The general colour of the leaf and petiole is of a deep rich green, and of about the same intensity on both sides, becoming a little paler or almost white at the base of the petiole.

Inflorescence spikes come out together with or before the leaves; when these appear, they push the spike to one side, so that inflorescence is definitely lateral. By the middle of August lateral spikes decay and for a time flowers are not to be seen. In the second half of the monsoon all the plants have spikes coming out of the centre of the leaves i.e. spikes are central; for three years this proved an insoluble riddle. All the plants within the observation plot were with lateral spikes up to August; then suddenly and unaccountably such plants seemed to disappear and a new set of plants with central spikes take their place. For all this unfortunate riddle we have Cooke and his key to thank. The solution of the puzzle was only found when eventually a plant was noticed with a large central spike and the remains of a decaying lateral spike still attached to the same plant. This at once suggested that *one and the same plant* had lateral and central spikes at different periods. After this, plants were collected wherever they showed a lateral spike: on dissecting such plants, invariably we found that there was a central spike still enveloped by the leaf sheaths but with the upper coma bracts already coloured rose or purple. On July 21st, 1945, a number of plants were examined for the double spike; the lateral spike was fresh, in full bloom; at first the central spike seemed to be absent altogether, but after careful dissection a minute central spike was found in most plants, the 'embryonic' spike being only about 1.5 cms. long and about 3 to 5 mm. at its broadest, and completely colourless. From observation of the living plant we may, therefore, say that *Curcuma pseudomontana* Grah. has a lateral spike at the beginning of the flowering season ('flowering spike vernal or aestival, lateral' Cooke) and a central one at the end of

the rains ('flowering spike autumnal, rising in the centre of a previously formed tuft of leaves', Cooke). It is obvious, therefore, that such keys as are to be found in Cooke, Schumann, Baker, etc. where the basis for the classification of the various specimens of *Curcuma* is the position (lateral or central) of the spike, must be scrapped altogether.

The size of the spike varies considerably with the season; the biggest spikes generally occurring during the second part of the monsoon, i.e. during September and early October. In June the spikes are small, from 6 to 12 cms. long and 2 to 3 cms. in diameter, with a peduncle 6 to 10 cms. long. At the end of September some of the spikes measured in Khandala were  $25 \times 13.5$  cms. with a peduncle 40 cms. long.

Floral bracts green, or green with purplish or reddish tips, rounded, saccate, a little shorter than the bracts of the coma. Each flowering bract subtends sometimes three, most often four, and occasionally five flower buds which open out successively.

'Sterile' bracts of the coma are very variable in colour; the following are some of the colour variations noticed in Khandala:

- (i) Uniform pink of various shades; this is the commonest colour.
- (ii) Pure white all through. (iii) Pure white with pink tips. (iv) White with pink tips and a broad stripe or stripes of pink colour running down along the centre of the bract. (v) White with several green stripes running longitudinally downwards and parallel to each other. (vi) Pink with very deep purple, almost black, tips. The size of the coma bracts is up to 9 to  $10 \times 4.5$  cms. Generally the brightly coloured coma bracts are sterile; but towards the end of the season they often support a number of buds or flowers, especially bracts away from the very apex of the spike. Both coma and floral bracts are free in the upper part, but are attached to the spike by their bases and lower portions of the sides, thus forming a sac-like cavity for the flowers. The venation of all bracts is very prominent, parallel, and in the case of the lower bracts often marked with greenish or purplish lines.

Calyx membranous, about 10 mm. long, or occasionally going up to 18 mm. in length; 3-lobed, the lobes 4 to 6 mm. long and about as broad, rounded or subacute at the apex; occasionally the calyx splits longitudinally down one side. The colour of the calyx is pale creamy yellow almost white.

Corolla at first pale cream in colour with a touch of pink at the tips of the petals, later on turning completely yellow; up to 6.4 cms. long; corolla tube up to 3 cms. long, 3 to 4 mm. broad at the height of the calyx mouth; corolla limb 1.5 cms. in diameter. Petals subequal, or the dorsal petal larger than the other two, ovate, acute or mucronate; lateral petals ovate, obtuse, with hyaline margins.

Stamen one, 5 to 7 mm. long including the spur at the base, two celled, each cell ending in a spur slightly curving outwards; anther connate with the staminodes, filament short, almost 0; the whole stamen white. Staminodes two, petaloid, ovate-oblong, slightly oblique at the apex, obtuse almost truncate, free limb

12 x 9 mm. Dehiscence of the anther cells seems to be through a small pore in each cell near the base.

Lip divided to half its length or merely notched, with two lines of reticulately spongy tissue running down the whole length of the lip along the centre; lip 12 x 12 mm. Lip and staminodes bright yellow, uniform in colour with the petals.

Style filiform, up to 38 mm. long, pale white in colour; stigma small, variously lobed; nectaries two near the base of the style, 5 mm. long, 1 mm. broad and about 0.5 mm. thick, rounded at the tip, whitish in colour. Ovary 3-locular, inferior, densely hirsute outside, the hairs being short, whitish and pointing upwards; the whole ovary greyish in colour. Fruit 3-locular, trigonous, 1.3 x 1 cm., white in colour at maturity; seeds numerous, arillate with a hyaline aril. Given the large number of flowers produced by the plant, it is remarkable that the number of fruits is not correspondingly large. This may be due to the fact that in many flowers fertilisation does not take place at all, or if it does, insects get at the fruit too soon and destroy it in the early stages; towards the end of the rainy season it is rare to find a fruit which has not been more or less damaged by insects.

#### A FEW NOTES ON THE NOMENCLATURE OF THE KHANDALA CURCUMA.

Graham called his plant *C. pseudomontana*, and the description, however imperfect it may be in many respects, seems to apply to the Khandala *Curcuma*. Baker in Hooker's Fl. Br. I. (6: 214, Dec. 1890), and Schumann in Engler's Pflanzenreich (iv, 46, p. 106, Nov. 1903) reduce Graham's *C. pseudomontana* to *C. montana* Roxb.; Index Kewensis (i: 672, 1895) gives *C. pseudomontana* Grah. as 'nomen rejiciendum', and mentions *C. montana* Roxb. as the only correct name. Cooke (II, 731) makes a few apposite remarks on the subject that deserve consideration. The question of the colour of the tubers must be left aside altogether, as it varies not with the species but with the age of the plant. Roxburgh says of *C. montana*: 'bulb conic, with pale yellow, palmate tubers'; Schumann adds that the tubers are sessile with fleshy roots. Graham clearly states (Cat. no. 1477) that in his plants the bulb or root is oblong, and that 'from it descend rather stout fibres bearing at their ends round tubers of the size of a small potato'. We have examined hundreds of specimens in Khandala at various times, and in every single case the tubers were found to be oblong or globose, but never palmate, and always at the end of long fleshy roots, never sessile.

The question as to whether the spike is vernal or autumnal, lateral or central, seems also to have vexed many of the authors who have written on the *Scitamineae*; but the cause of such a confusion must be attributed to defective observation of the plant, which has the 'unfortunate' habit of bursting into flower during the most unpleasant part of the year.

Whilst reading carefully through the description of *Curcuma Randa* Prain in J.B.N.H.S. (ii: 463, 1898) one cannot fail to notice the very close similarities between Prain's new species and Graham's *Curcuma pseudomontana*. For three years I have examined

## MISCELLANEOUS NOTES

- specimens of *Curcuma* growing on the upper slopes of Bhoma Hill, where due to the exposed position of the plants, they go through the monsoon as dwarfed specimens; when these dwarf plants are compared with *Curcuma Ranadei* Pr., it is impossible to see any difference between them; and the Bhoma Hill specimens are decidedly *Curcuma pseudomontana* Grah.

## NEW KEY TO THE CURCUMAS OF BOMBAY PRESIDENCY.

In order to facilitate the identification of Bombay *Curcumas*, the following key is proposed, where the whole question of lateral and central spikes has been left aside as unsatisfactory; this key is purely artificial, and is intended for the convenience of field workers who may in the past have experienced some difficulty in identifying their *Curcumas* from the key supplied by Cooke. The basis of the present key is the colour of the flowers, which seems to be permanent for a given species of *Curcuma*; the only claim we make for the present key is that it has been used for the last two years and has been found to be helpful and correct.

In the present key we have included two new species of *Curcuma* described by Blatter in 1930, *Curcuma inodora* and *Curcuma purpurea*. I have omitted *C. Ranadei* Pr. as being synonymous with Graham's *C. pseudomontana*.

## Corolla yellow:

## Rhizome small:

No tubers at the end of the root fibres:	...	...	<i>C. neilgherrensis</i> .
Small subglobose tubers at the end of the root fibres	...	...	<i>C. pseudomontana</i> .
Rhizome large; tubers sessile	...	...	<i>C. amada</i> .
Corolla white or yellowish white	...	...	<i>C. amada</i> .

## Corolla purple:

## Corolla with a yellow streak on the lip:

## Tubers numerous:

Tubers at the end of the root fibres	...	...	<i>C. inodora</i> .
Tubers sessile, palmately divided	...	...	<i>C. aromatica</i> .
Tuber one, sessile	...	...	<i>C. purpurea</i> .
Corolla without a yellow streak on the lip	...	...	<i>C. decipiens</i> .

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